United States Department of Agriculture

Soil Conservation Service

In cooperation with Kansas Agricultural Experiment Station

Soil Survey of Trego County, Kansas

How To Use This Soil Survey

General Soil Map

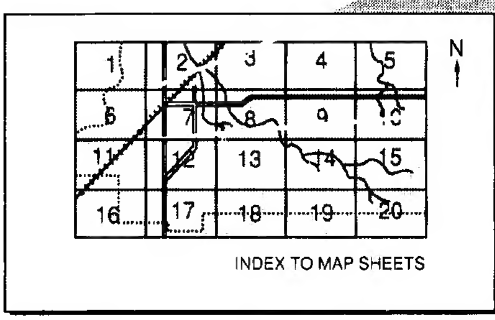
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

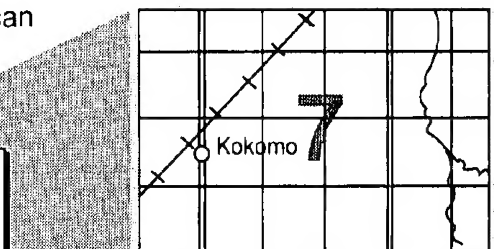
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

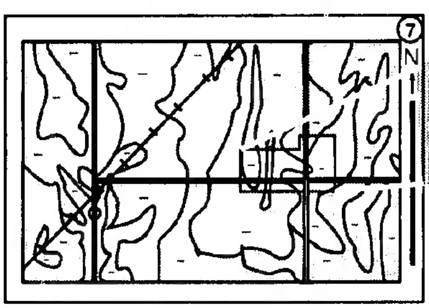


INDEX TO MAP SHEETS



MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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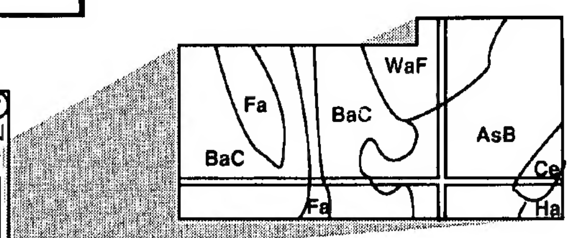

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was performed in the period 1984 to 1986. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Trego County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Cedar trees in an area of Heizer-Brownell gravelly loams, 5 to 30 percent slopes. This area provides excellent habitat for deer.

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Soil Series

Issued February 1990

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Trego County, Kansas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

James N. Habiger
State Conservationist
Soil Conservation Service

Soil Survey of Trego County, Kansas

By Cleveland E. Watts, Cecil D. Palmer, and Stanley A. Glaum,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Kansas Agricultural Experiment Station

TREGO COUNTY is in the northwestern part of Kansas (fig. 1). It has a total area of 576,416 acres, or about 900 square miles. In 1985, the population was 4,359. About half of the population lives in WaKeeney, the county seat. The rest generally lives in the smaller towns of Collyer and Ogallah.

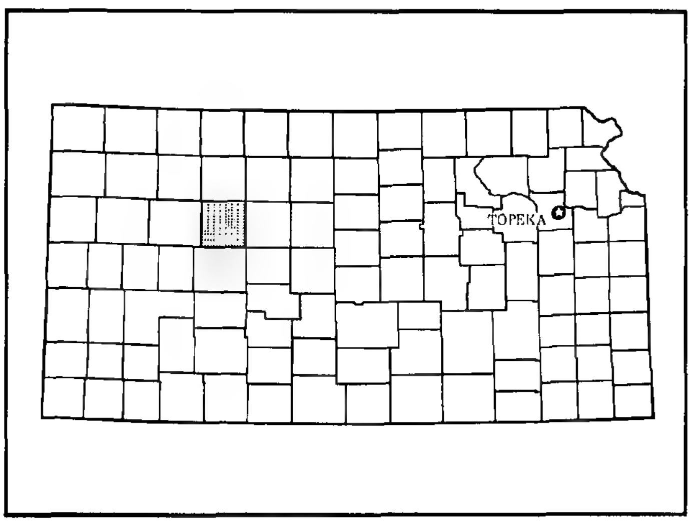

Figure 1.—Location of Trego County in Kansas.

Trego County is in the Rolling Plains and Breaks major land resource area. Elevation ranges from about 2,000 feet above sea level, in an area where the Smoky Hill River leaves the county, to about 2,600 feet, in an area west of Collyer. The county is drained by the Smoky Hill River, the Saline River, Big Creek, and the tributaries of these streams.

The economy of the county is based primarily on farming, ranching, oil production, and related enterprises.

General Nature of the County

This section describes the climate and natural resources in the county.

Climate

Prepared by L. Dean Bark, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Trego County is typical continental, as can be expected of a location in the interior of a large landmass in the middle latitudes. The climate is characterized by large daily and annual variations in temperature. Winters are cold because of frequent outbreaks of polar air. The cold temperatures prevail only from December to February. Warm summer temperatures prevail for about 6 months every year. They provide a long growing season for the crops grown in the county. Spring and fall are relatively short.

Trego County is generally to the west of the flow of moisture-laden air from the Gulf of Mexico and is to the east of the strong rain-shadow effects of the Rocky Mountains. As a result, the annual amount of precipitation is marginal for cropping year after year. The precipitation generally falls during showers and thunderstorms that can be extremely heavy at times. Winds are relatively high and can cause significant soil loss and crop damage in the drier years.

Table 1 gives data on temperature and precipitation for the survey area as recorded at WaKeeney in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 31.2 degrees F, and the average daily minimum temperature is 18.9 degrees. The lowest temperature on record, which occurred at WaKeeney on January 12, 1912, is -25 degrees. In summer the average temperature is 75.6 degrees, and the average daily maximum temperature is 88.1 degrees. The highest recorded temperature, which occurred on July 24, 1936, is 115 degrees.

The total annual precipitation is 23.38 inches. Of this, 17.61 inches, or about 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11.79 inches. The heaviest 1-day rainfall on record was 7.40 inches at WaKeeney on July 29, 1928.

Severe windstorms and occasional tornadoes accompany well developed thunderstorms, but they are infrequent and of local extent. Losses from hail are more severe, but they are not so great as the losses in counties to the west of this county.

The average seasonal snowfall is 34.3 inches. The highest recorded seasonal snowfall, which occurred during the winter of 1957-58, is 76.5 inches. On the average, 31 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The sun shines 78 percent of the time possible in summer and 67 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in March.

Natural Resources

William C. Crawford, district conservationist, Soil Conservation Service, helped prepare this section.

Soil is the most important natural resource in the county. It provides a growing medium for cash crops and for the grasses grazed by livestock. On about 60 percent of the acreage in the county, the soils are suited to cultivated crops. The steeper, shallow and moderately deep soils produce good-quality native grasses.

Adequate quantities of underground water are available for domestic uses and livestock throughout most of the county. Ground water in sufficient quantity for irrigation is available in the west-central part of the county and in the areas of valley fill along the Smoky Hill River. The water in the west-central part is from the Ogallala Formation.

The county has an adequate supply of sand and gravel for local use. The source is the Ogallala Formation.

In 1929, oil was discovered in the north-central part of the county. Currently, productive wells are in scattered areas throughout the county.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are named and mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The descriptions and names of the soils identified on the general soil map of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

Soil Descriptions

1. Armo-Heizer-Brownell Association

Deep to shallow, moderately sloping to steep, well drained and somewhat excessively drained soils that have a loamy subsoil; on uplands

This association is on foot slopes and side slopes that are dissected by many short drainageways. Some areas have deeply entrenched valleys. Outcrops of limestone bedrock are common on the steeper slopes. Slopes range from 2 to 30 percent.

This association makes up about 13 percent of the county. It is about 43 percent Armo soils, 17 percent Heizer soils, 15 percent Brownell soils, and 25 percent minor soils (fig. 2).

The deep, moderately sloping and strongly sloping, well drained Armo soils formed in calcareous, loamy colluvium on foot slopes and the lower side slopes. Typically, the surface layer is grayish brown, calcareous loam about 10 inches thick. The subsurface layer is brown, calcareous loam about 6 inches thick. The subsoil is friable, calcareous loam about 22 inches thick. The upper part is pale brown, and the lower part is very pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous loam.

The shallow, moderately sloping to steep, somewhat excessively drained Heizer soils formed in chalky limestone residuum on side slopes above areas where limestone crops out. Typically, the surface layer is grayish brown, calcareous gravelly loam about 6 inches thick. The next 3 inches is dark grayish brown, friable, calcareous very channery loam. The substratum is light brownish gray, calcareous very channery loam about 6 inches thick. White, hard limestone is at a depth of about 15 inches.

The moderately deep, gently sloping to strongly sloping, well drained Brownell soils formed in chalky limestone residuum on side slopes. Typically, the surface layer is brown, calcareous gravelly loam about 8 inches thick. The subsoil is grayish brown, calcareous very channery loam about 4 inches thick. The substratum is white, calcareous very channery loam about 16 inches thick. Hard, chalky limestone is at a depth of about 28 inches.

The minor soils in this association are the Bogue, Dorrance, Humbarger, Mento, and Wakeen soils. The clayey Bogue soils and the excessively drained Dorrance soils are on side slopes. The deep Humbarger soils are on flood plains. The slowly permeable Mento soils are on ridgetops. The moderately deep Wakeen soils are on side slopes and breaks.

This association is used dominantly as range. Maintaining the growth and vigor of the desirable grasses and forbs is the main concern in managing range.

2. Penden-Armo Association

Deep, moderately sloping and strongly sloping, well drained soils that have a loamy subsoil; on uplands

This association is on foot slopes and side slopes that are dissected by many short drainageways. Some areas have deeply entrenched valleys. Outcrops of shale bedrock are common on the steeper slopes. Slopes range from 3 to 15 percent.

This association makes up about 15 percent of the county. It is about 55 percent Penden soils, 15 percent Armo soils, and 30 percent minor soils (fig. 3).

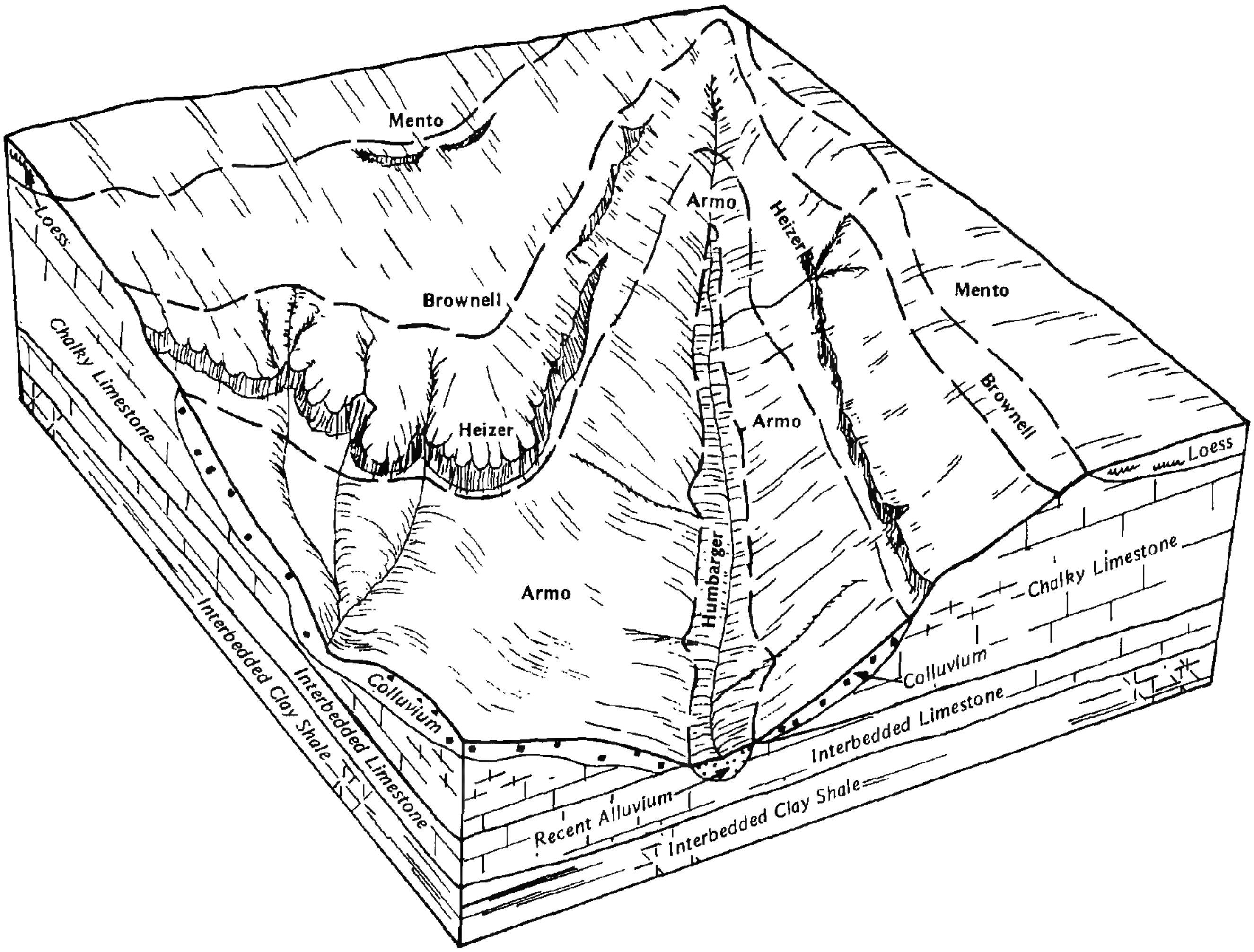

Figure 2.—Pattern of soils and parent material in the Armo-Heizer-Brownell association.

The Penden soils formed in calcareous, loamy sediments on side slopes. Typically, the surface layer is dark grayish brown, calcareous loam about 8 inches thick. The subsurface layer is grayish brown, calcareous loam about 6 inches thick. The subsoil is very pale brown, friable, calcareous loam about 18 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous loam.

The Armo soils formed in calcareous, loamy colluvium on foot slopes and the lower side slopes. Typically, the surface layer is grayish brown, calcareous loam 10 inches thick. The subsurface layer is brown, calcareous loam about 6 inches thick. The subsoil is friable, calcareous loam about 22 inches thick. The upper part is pale brown, and the lower part is very pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous loam.

The minor soils in this association are the Canlon, Carlson, Holdrege, Humbarger, Uly, and Wakeen soils. The shallow Canlon soils are on the steeper breaks. Carlson and Holdrege soils are on gently sloping side slopes. The loamy Humbarger soils are on flood plains. The moderately deep Wakeen soils are on the upper side slopes. Uly soils are on gently sloping and moderately sloping side slopes.

About half of this association is used for cultivated crops, and half is used as range. Wheat, grain sorghum, and forage sorghum are the chief crops. Controlling erosion, conserving moisture, and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of the desirable grasses and forbs is the main concern in managing range.

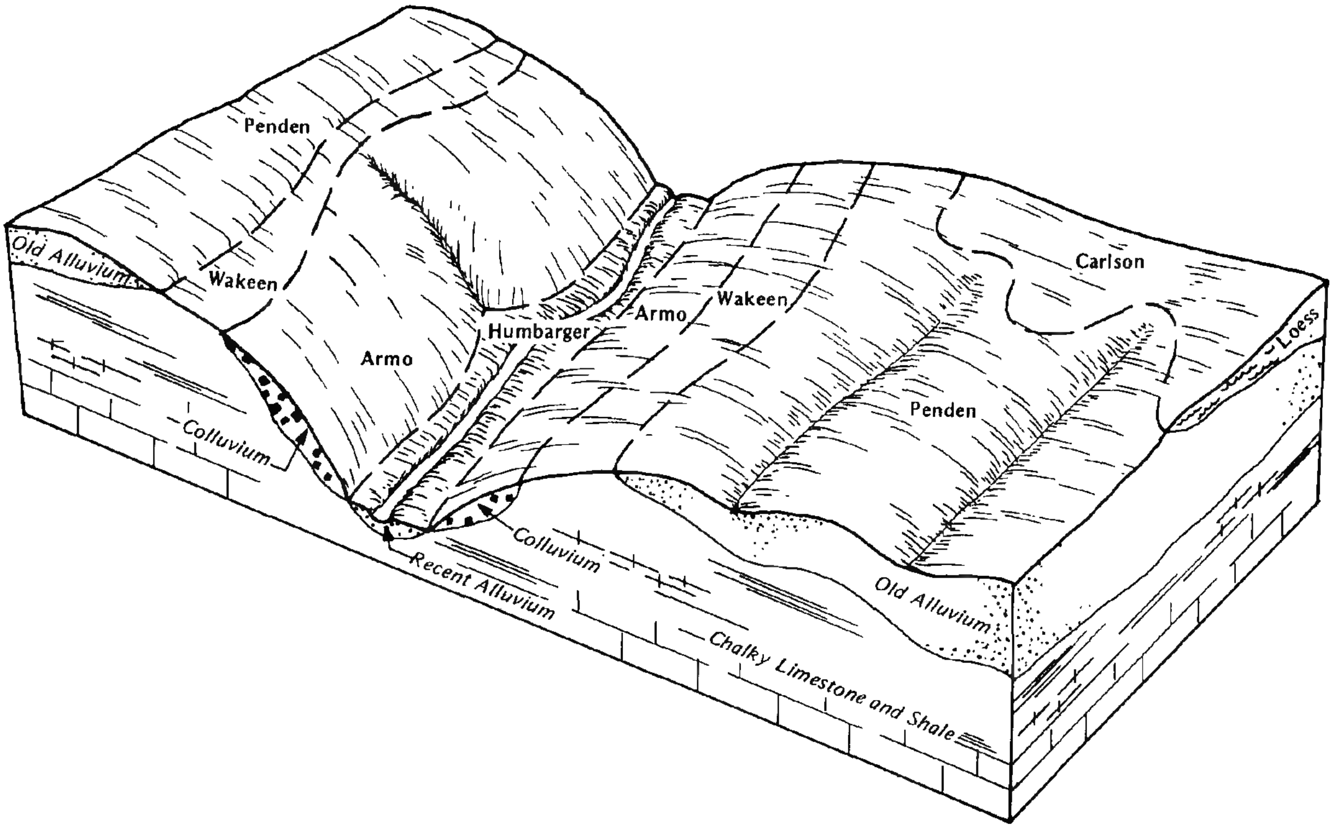

Figure 3.—Pattern of soils and parent material in the Penden-Armo association.

3. Armo-Harney-Wakeen Association

Deep and moderately deep, gently sloping and moderately sloping, well drained soils that have a loamy or silty subsoil; on uplands

This association is on ridgetops, foot slopes, and side slopes that are dissected by many intermittent drainageways and small streams. Slopes range from 1 to 8 percent.

This association makes up about 14 percent of the county. It is about 45 percent Armo soils, 15 percent Harney soils, 7 percent Wakeen soils, and 33 percent minor soils.

The deep, gently sloping and moderately sloping Armo soils formed in calcareous, loamy colluvium on foot slopes and the lower side slopes. Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The subsurface layer also is grayish brown, calcareous loam. It is about 8 inches thick. The subsoil is friable, calcareous loam about 16 inches thick. The upper part is pale brown, and the lower part is very pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous loam.

The deep, gently sloping Harney soils formed in loess on ridgetops. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer also is grayish brown silt loam. It is about 6 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable silty clay loam; the next part is pale brown, firm and friable silty clay loam; and the lower part is very pale brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The moderately deep, gently sloping and moderately sloping Wakeen soils formed in material weathered from chalky limestone on side slopes. Typically, the surface layer is grayish brown, calcareous silt loam about 4 inches thick. The subsurface layer is grayish brown, calcareous silty clay loam about 7 inches thick. The subsoil is friable, calcareous silty clay loam about 11 inches thick. The upper part is light yellowish brown, and the lower part is pale yellow. The substratum is white, calcareous silt loam about 11 inches thick. Chalky limestone is at a depth of about 33 inches.

The minor soils in this association are the Brownell, Holdrege, Mento, Nibson, and Penden soils. The loamy

Brownell soils are on side slopes. The deep, silty Holdrege and Mento soils are on gently sloping side slopes. The shallow Nibson soils are on the lower side slopes. The loamy Penden soils are on the upper side slopes.

About half of this association is used for cultivated crops, and half is used as range. Wheat, grain sorghum, and forage sorghum are the chief crops. Controlling erosion, conserving moisture, and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of the desirable grasses and forbs is the main concern in managing range.

4. Harney-Holdrege Association

Deep, nearly level and gently sloping, well drained soils that have a silty subsoil; on uplands

This association is on ridgetops and side slopes that are dissected by many intermittent drainageways and small streams. Slopes range from 0 to 3 percent.

This association makes up about 29 percent of the county. It is about 49 percent Harney soils, 45 percent Holdrege soils, and 6 percent minor soils.

The nearly level and gently sloping Harney soils formed in loess on broad ridgetops. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer also is grayish brown silt loam. It is about 6 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable silty clay loam; the next part is pale brown, firm and friable silty clay loam; and the lower part is very pale brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The gently sloping Holdrege soils formed in loess on ridgetops and side slopes. Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer also is dark grayish brown silt loam. It is about 4 inches thick. The subsoil is about 18 inches thick. It is friable. The upper part is brown and light yellowish brown silty clay loam, and the lower part is light yellowish brown silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The minor soils in this association are the Humbarger, Mento, Penden, Uly, and Wakeen soils. The deep Humbarger soils are on flood plains. The deep Mento soils are on gently sloping side slopes. The loamy Penden soils are on the lower side slopes. The deep Uly soils are on moderately sloping side slopes. The moderately deep Wakeen soils are on side slopes and breaks.

About three-fourths of this association is used for cultivated crops, and the rest is used mainly as range. Wheat, grain sorghum, and forage sorghum are the chief crops. Controlling erosion, conserving moisture, and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of the desirable grasses and forbs is the main concern in managing range.

5. Carlson-Penden-Holdrege Association

Deep, gently sloping and moderately sloping, well drained soils that have a silty or loamy subsoil; on uplands

This association is on side slopes that are dissected by many intermittent drainageways and small streams. Slopes range from 1 to 7 percent.

This association makes up about 20 percent of the county. It is about 36 percent Carlson soils, 33 percent Penden soils, 12 percent Holdrege soils, and 19 percent minor soils (fig. 4).

The gently sloping Carlson soils formed in loess over calcareous old alluvium. They are on side slopes. Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. It is friable. The upper part is yellowish brown silty clay loam; the next part is light yellowish brown, calcareous silty clay loam; and the lower part is very pale brown, calcareous clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous clay loam.

The moderately sloping Penden soils formed in calcareous, loamy sediments on side slopes. Typically, the surface layer is dark grayish brown, calcareous loam about 8 inches thick. The subsurface layer is grayish brown, calcareous loam about 6 inches thick. The subsoil is very pale brown, friable, calcareous loam about 18 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous loam.

The gently sloping Holdrege soils formed in loess on side slopes. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 18 inches thick. It is friable. The upper part is brown and light yellowish brown silty clay loam, and the lower part is light yellowish brown silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The minor soils in this association are the Campus, Canlon, Humbarger, and Uly soils. The moderately deep Campus soils are on moderately sloping side slopes. The shallow, somewhat excessively drained Canlon soils are on moderately sloping and strongly sloping side slopes. The deep Humbarger soils are on flood plains. The deep Uly soils are on side slopes.

About two-thirds of this association is used for cultivated crops, and the rest is used mainly as range. Wheat, grain sorghum, and forage sorghum are the chief crops. Controlling erosion, conserving moisture, and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth

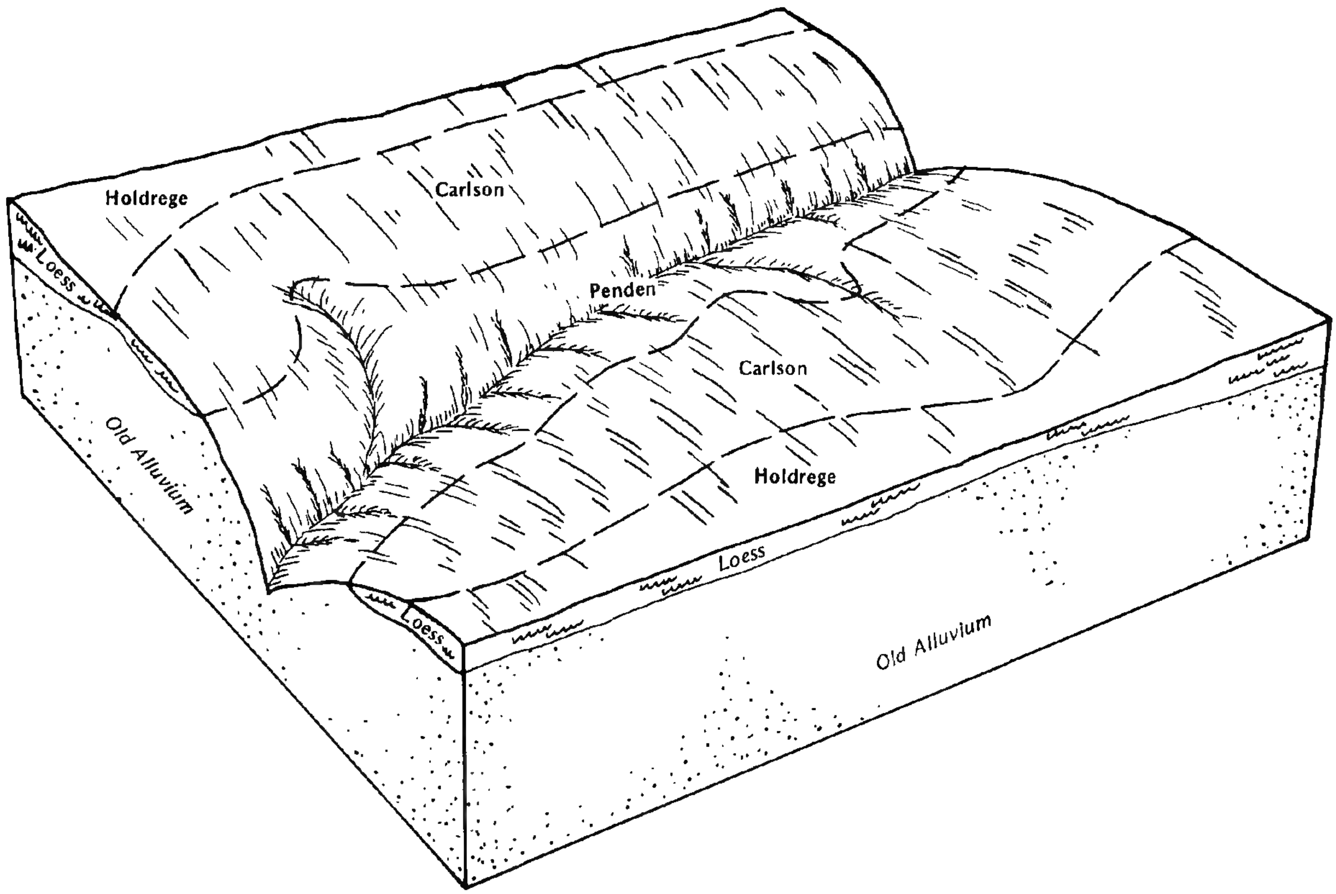

Figure 4.—Pattern of soils and parent material in the Carlson-Penden-Holdrege association.

and vigor of the desirable grasses and forbs is the main concern in managing range.

6. Humbarger-Munjor-Hord Association

Deep, nearly level, well drained soils that have a loamy, silty, or sandy subsoil; on flood plains and stream terraces

This association is on flood plains and terraces along the major streams in the county. The Humbarger soils are occasionally flooded or frequently flooded. The Munjor soils are occasionally flooded. The Hord soils are subject to rare flooding. Slopes range from 0 to 2 percent.

This association makes up about 9 percent of the county. It is about 57 percent Humbarger soils, 15 percent Munjor soils, 14 percent Hord soils, and 14 percent minor soils.

The Humbarger soils formed in loamy alluvium on flood plains. Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The subsurface layer is dark grayish brown, calcareous loam about 14 inches thick. The next 12 inches is grayish brown, friable, calcareous loam. The substratum to a depth of about 60 inches is pale brown, calcareous loam.

The Munjor soils formed in loamy and sandy alluvium on flood plains. Typically, the surface layer is pale brown, calcareous sandy loam about 8 inches thick. The substratum is calcareous. The upper part is light brownish gray sandy loam, the next part is light brownish gray fine sandy loam, and the lower part to a depth of about 60 inches is light gray loamy sand.

The Hord soils formed in a mixture of loess and alluvium on stream terraces. Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark gray silt loam about 13 inches thick. The subsoil is about 17 inches thick. It is friable. The upper part is grayish brown silty clay loam, and the lower part is pale brown silt loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

The minor soils in this association are the silty McCook and Roxbury and sandy Inavale soils on flood plains.

This association is used dominantly for cultivated crops. Some areas are used as range. Wheat, grain sorghum, forage sorghum, and alfalfa are the chief crops. Controlling flooding and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of the desirable grasses and forbs is the main concern in managing range.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Holdrege silt loam, 1 to 3 percent slopes, is a phase of the Holdrege series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Heizer-Brownell gravelly loams, 5 to 30 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The Badland part of the Badland-Manvel complex is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be show are identified by a special symbol on the soil maps.

The descriptions and names of the soils identified on the detailed soil maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ap—Armo loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on foot slopes and the lower side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 120 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The subsurface layer also is grayish brown, calcareous loam. It is about 8 inches thick. The subsoil is friable, calcareous loam about 16 inches thick. The upper part is pale brown, and the lower part is very pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous loam. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Mento and Wakeen soils. The silty Mento soils have more clay in the subsoil than the Armo soil. They are in gently sloping areas below the Armo soil. The moderately deep Wakeen soils are on the upper side slopes. Included soils make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the Armo soil. Available water capacity is high. Runoff and natural fertility are medium. The surface

layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About three-fourths of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About one-fourth of the acreage is range. The native vegetation is dominantly big bluestem, little bluestem, and indiangrass. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss and blue grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIe, and the range site is Limy Upland.

Ar—Armo loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on foot slopes and the lower side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 120 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 10 inches thick. The subsurface layer is grayish brown, calcareous loam about 9 inches thick. The subsoil is friable, calcareous clay loam about 18 inches thick. The upper part is pale brown, and the lower part is very pale brown. The substratum is very pale brown and calcareous. The upper part is clay loam, and the lower part to a depth of about 60 inches is loam.

Included with this soil in mapping are small areas of the moderately deep Wakeen soils on the upper side slopes. These soils make up about 5 percent of the map unit.

Permeability and the organic matter content are moderate in the Armo soil. Available water capacity is high. Runoff and natural fertility are medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About half of the acreage is used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About half of the acreage is range. The native vegetation is dominantly big bluestem, little bluestem, and indiangrass. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss and blue grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIIe, and the range site is Limy Upland.

As—Armo loam, 7 to 15 percent slopes. This deep, strongly sloping, well drained soil is on foot slopes and the lower side slopes in the uplands. Individual areas are irregular in shape and range from 30 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 10 inches thick. The subsurface layer is brown, calcareous loam about 6 inches thick. The subsoil is friable, calcareous loam about 22 inches thick. The upper part is pale brown, and the lower part is very pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous loam.

Included with this soil in mapping are small areas of Dorrance, Humbarger, and Wakeen soils. Dorrance soils are loamy in the upper part and sandy and gravelly in the lower part. They are in positions on the landscape similar to those of the Armo soil. Humbarger soils are on flood plains. The moderately deep Wakeen soils are on the upper side slopes. Included soils make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the Armo soil. Available water capacity is high. Runoff is rapid. Natural fertility is medium.

Most areas are used as range. Because of the hazard of water erosion, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly big bluestem, little bluestem, and indiangrass. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss and blue grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

This soil is moderately well suited to dwellings and septic tank absorption fields and is poorly suited to sewage lagoons. The slope is a limitation affecting all of these uses. Also, seepage is a limitation on sites for sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. The lateral lines in septic tank absorption fields should be installed on the contour. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction. Seepage can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is VIe, and the range site is Limy Upland.

Bd—Badland-Manvel complex, 3 to 20 percent slopes. This map unit is in moderately sloping to moderately steep areas on breaks and foot slopes in the uplands. The Badland is dissected by many intermittent drainageways. The deep, well drained Manvel soil is on the foot slopes. Individual areas are irregular in shape and range from 80 to 640 acres in size. They are about 65 percent Badland and 20 percent Manvel soil. The Badland and the Manvel soil occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Badland is barren land consisting mainly of Smoky Hill Chalk.

Typically, the Manvel soil has a surface layer of light brownish gray, calcareous silt loam about 3 inches thick. The next 7 inches is light gray, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Included with the Badland and the Manvel soil in mapping are small areas of soils that are moderately deep to very shallow and do not have a dark surface layer. Also included are Armo and Wakeen soils. The calcareous, loamy Armo soils are on foot slopes and the lower side slopes. The moderately deep Wakeen soils are on side slopes above the Badland. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Badland and in the Manvel soil. Runoff is rapid. Available water capacity, natural fertility, and the organic matter content are very low in the Badland and low in the Manvel soil. The shrink-swell potential is moderate in the subsoil of the Manvel soil.

Most areas are used as range. Because of the hazard of water erosion and the restricted available water capacity, this map unit is generally unsuited to cultivated crops. It is better suited to range. The Badland does not support vegetation. The native vegetation on the Manvel soil is dominantly big bluestem, blue grama, and fourwing saltbush. If the range is overgrazed, these grasses are replaced by less desirable vegetation, such as broom snakeweed and sideoats grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

The Badland is generally unsuited to building site development. The Manvel soil is moderately well suited to dwellings. It is well suited to septic tank absorption fields, but it is poorly suited to sewage lagoons. The slope of this soil is a limitation on sites for dwellings and sewage lagoons. Also, the shrink-swell potential is a limitation on sites for dwellings, and seepage is a limitation on sites for sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction. Seepage can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is VIIs. The Manvel soil is in the Chalk Flats range site, and the Badland is not assigned to a range site.

Bg—Bogue clay, 8 to 25 percent slopes. This moderately deep, strongly sloping to steep, moderately well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 80 to 320 acres in size.

Typically, the surface layer is gray clay about 6 inches thick. The subsoil is gray, extremely firm clay about 13 inches thick. The substratum is olive gray clay about 8 inches thick. Dark gray, clayey shale is at a depth of about 27 inches. In places the depth to shale is less than 20 inches.

Included with this soil in mapping are small areas of Armo and Dorrance soils. These soils make up about 5 percent of the map unit. They are deep, are calcareous throughout, and have less clay throughout than the

Bogue soil. Armo soils are on foot slopes and side slopes below the Bogue soil, and Dorrance soils are on side slopes above the Bogue soil.

Permeability is very slow in the Bogue soil, and runoff is rapid. Available water capacity is very low. The organic matter and natural fertility are low. Root penetration is restricted by the shale at a depth of 20 to 40 inches. The shrink-swell potential is high in the subsoil.

Most areas are used as range. Because of the hazard of water erosion and the very low available water capacity, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly big bluestem, little bluestem, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss and blue grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is poorly suited to dwellings, septic tank absorption fields, and sewage lagoons. The slope is a limitation affecting all of these uses. Also, the depth to bedrock and seepage are limitations on sites for septic tank absorption fields and sewage lagoons, and the shrink-swell potential is a limitation on sites for dwellings. The deeper included soils are better sites for buildings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The buildings should be designed so that they conform to the natural slope of the land. Because of seepage, the floor and walls of sewage lagoons should be sealed.

The land capability classification is VIe, and the range site is Blue Shale.

Br—Brownell gravelly loam, 2 to 10 percent slopes. This moderately deep, gently sloping to strongly sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 120 acres in size.

Typically, the surface layer is brown, calcareous gravelly loam about 8 inches thick. The subsoil is grayish brown, friable, calcareous very channery loam about 4 inches thick. The substratum is white, calcareous very channery loam about 16 inches thick. Hard, chalky limestone is at a depth of about 28 inches (fig. 5).

Included with this soil in mapping are small areas of Armo, Heizer, Mento, and Wakeen soils. The deep Armo soils are on side slopes above the Brownell soil and on foot slopes below the Brownell soil. The shallow Heizer soils are on side slopes below the Brownell soil. The deep Mento soils have a dominantly clayey subsoil. They are in gently sloping areas above the Brownell soil. The silty Wakeen soils are moderately deep over chalk bedrock. They are on side slopes above the Brownell soil.

Figure 5.—Profile of Brownell gravelly loam, 2 to 10 percent slopes. This soil is 20 to 40 inches deep over chalky limestone. Depth is marked in feet.

Permeability is moderate in the Brownell soil, and runoff is rapid. Available water capacity, the organic matter content, and natural fertility are low. Root penetration is restricted by the chalky limestone at a depth of 20 to 40 inches.

Most areas are used as range. Because of the hazard of water erosion, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly big bluestem, little bluestem,

and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss, blue grama, and tall dropseed. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

This soil is moderately well suited to dwellings without basements, is generally unsuited to dwellings with basements, and is poorly suited to septic tank absorption fields and sewage lagoons. The depth to bedrock is a limitation affecting all of these uses. Also, seepage is a limitation on sites for septic tank absorption fields and sewage lagoons, and the slope is a limitation on sites for sewage lagoons. The deeper, less sloping included soils are better sites for buildings. Because of seepage, the floor and walls of sewage lagoons should be sealed.

The land capability classification is VIe, and the range site is Limy Upland.

Cc—Campus-Canlon loams, 6 to 30 percent slopes. These moderately sloping to steep soils are on upland side slopes dissected by deeply entrenched drainageways. The moderately deep, well drained Campus soil is on the less sloping, upper side slopes. The shallow, somewhat excessively drained Canlon soil is on the steeper mid slopes directly above areas where caliche crops out. Individual areas are long and narrow and range from 10 to several hundred acres in size. They are about 55 percent Campus soil and 30 percent Canlon soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Campus soil has a surface layer of dark grayish brown, calcareous loam about 7 inches thick. The subsoil is calcareous loam about 29 inches thick. It is grayish brown and friable in the upper part and white in the lower part. White, hard caliche is at a depth of about 36 inches. In places the depth to hard caliche is more than 40 inches.

Typically, the Canlon soil has a surface layer of light brownish gray, calcareous loam about 5 inches thick. The next 3 inches is light gray, calcareous loam. The substratum is white, calcareous gravelly loam about 10 inches thick. White, hard caliche is at a depth of about 18 inches.

Included with these soils in mapping are small areas of Humbarger soils and caliche outcrops. The deep Humbarger soils are on flood plains. The caliche outcrops are on steep bluffs below the Campus and Canlon soils. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the Campus and Canlon soils, and runoff is rapid. Available water capacity and natural fertility are low. The organic matter content is moderate in the Campus soil and low in the Canlon soil. Root penetration is restricted by the caliche at a depth of 20 to 40 inches in the Campus soil and 10 to 20 inches in the Canlon soil.

Most areas are used as range. Because of the hazard of water erosion on both soils and the shallowness to hard caliche in the Canlon soil, these soils are generally unsuited to cultivated crops. They are better suited to range. The native vegetation is dominantly big bluestem, little bluestem, and switchgrass. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as blue grama and hairy grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

The Campus soil is poorly suited to dwellings, septic tank absorption fields, and sewage lagoons. The depth to bedrock is the main limitation. Also, slope and seepage are limitations on sites for sewage lagoons, and the slope is a limitation on sites for septic tank absorption fields.

The Canlon soil is generally unsuited to building site development because of the depth to bedrock and the slope.

The land capability classification is VIe. The Campus soil is in the Limy Upland range site, and the Canlon soil is in the Shallow Limy range site.

Cf—Carlson silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on broad ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. It is friable. The upper part is yellowish brown silty clay loam; the next part is light yellowish brown, calcareous silty clay loam; and the lower part is very pale brown, calcareous clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous clay loam. In some places the surface layer contains more sand. In other places the depth to lime is less than 12 inches.

Included with this soil in mapping are small areas of Holdrege and Penden soils. Holdrege soils have less clay in the subsoil than the Carlson soil. They are on gently sloping side slopes above the Carlson soil. The calcareous, loamy Penden soils are on side slopes below the Carlson soil. Also included are soils that have a gravelly surface layer. These soils are on gently sloping knobs above the Carlson soil. Included soils make up about 5 percent of the map unit.

Permeability is moderately slow in the Carlson soil, and runoff is medium. The organic matter content is moderate. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

This soil is well suited to dwellings. It is moderately well suited to septic tank absorption fields and sewage lagoons. The moderately slow permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage and slope are limitations on sites for sewage lagoons. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIe, and the range site is Loamy Upland.

Cu—Coly silt loam, 2 to 6 percent slopes. This deep, moderately sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is pale brown, calcareous silt loam about 4 inches thick. The next 4 inches is pale brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Included with this soil in mapping are small areas of Holdrege and Penden soils. These soils have a dark surface layer and have more clay in the subsoil than the Coly soil. Holdrege soils are on ridgetops and the upper side slopes. The loamy Penden soils are on side slopes below the Coly soil. Included soils make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the Coly soil. Available water capacity is high. Runoff is medium. Natural fertility is low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIIe, and the range site is Limy Upland.

Do—Dorrance sandy loam, 3 to 15 percent slopes. This deep, moderately sloping and strongly sloping, excessively drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 320 acres in size.

Typically, the surface layer is grayish brown, calcareous sandy loam about 11 inches thick. The next 5 inches is grayish brown, friable, calcareous gravelly sandy loam. The substratum is very pale brown and calcareous. The upper part is gravelly loamy sand, and the lower part to a depth of about 60 inches is gravelly sand.

Included with this soil in mapping are small areas of Armo, Humbarger, and Penden soils. These soils contain less sand in the subsoil than the Dorrance soil. Armo and Penden soils are on side slopes above the Dorrance soil. Humbarger soils are on flood plains. Included soils make up about 10 percent of the map unit.

Permeability is moderately rapid in the surface layer of the Dorrance soil and very rapid in the substratum. Runoff is medium. Available water capacity and natural fertility are low. The organic matter content is moderate.

Most areas are used as range (fig. 6). Because of the low available water capacity and the hazard of soil blowing, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly sand bluestem, little bluestem, and blue grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss and hairy grama. Soil blowing is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is moderately well suited to dwellings. It is generally unsuited to septic tank absorption fields and poorly suited to sewage lagoons. The slope is the main limitation on sites for dwellings. The buildings should be designed so that they conform to the natural slope of the land. The soil readily absorbs but does not adequately

Figure 6.—An area of Dorrance sandy loam, 3 to 15 percent slopes, used as range. Yucca plants are common on this soil.

filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water. Seepage and slope are limitations on sites for sewage lagoons. Seepage can be controlled by sealing the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is VIs, and the range site is Sands.

Ha—Harney silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on the broad tops of ridges in the uplands. Individual areas are irregular in shape and range from 80 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer also is grayish brown silt loam (fig. 7). It is about 6 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable silty clay loam; the next part is pale brown, firm and friable silty clay loam; and the lower part is very pale brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown,

calcareous silt loam. In areas where the upper part of the subsoil has been mixed with the surface soil by tillage, the surface layer is silty clay loam. In places the depth to lime is less than 18 inches.

Figure 7.—Profile of Harney silt loam, 0 to 1 percent slopes. The surface soil is dark. Depth is marked in feet.

Included with this soil in mapping are clayey soils in small depressions or swales. These soils make up about 2 percent of the map unit.

Permeability is moderately slow in the Harney soil, and runoff is slow. The organic matter content is moderate. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and forage sorghum. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective if the crop residue is managed by stubble mulching or by chemical fallow. The stubble traps snow and thus increases the moisture supply. Returning crop residue to the soil and adding other organic material improve fertility and tilth and increase the rate of water infiltration.

This soil is well suited to dwellings with basements. It is moderately well suited to dwellings without basements and to septic tank absorption fields and sewage lagoons. The shrink-swell potential is a limitation on sites for dwellings without basements. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The moderately slow permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIc, and the range site is Loamy Upland.

He—Harney-Mento silt loams, 1 to 3 percent slopes. These deep, gently sloping, well drained soils are on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 160 acres in size. They are about 55 to 65 percent Harney soil and 30 to 40 percent Mento soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Harney soil has a surface layer of grayish brown silt loam about 7 inches thick. The subsurface layer is brown silty clay loam about 4 inches thick. The subsoil is about 16 inches thick. It is firm. The upper part is brown silty clay, and the lower part is pale brown, calcareous silty clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Typically, the Mento soil has a surface layer of grayish brown silt loam about 8 inches thick. The subsoil is about 25 inches thick. It is firm and is slightly affected by sodium. The upper part is brown silty clay; the next part is pale brown, calcareous silty clay; and the lower part is light yellowish brown, calcareous silty clay loam. The substratum is calcareous. The upper part is light yellowish brown silt loam, and the lower part to a depth of about 60 inches is very pale brown clay loam.

Included with these soils in mapping are small areas of the calcareous, loamy Armo soils. These included soils are in gently sloping areas below the Harney and Mento soils. They make up about 5 percent of the map unit.

Permeability is moderately slow in the Harney soil and slow in the Mento soil. Runoff is medium on both soils. Available water capacity and natural fertility are high. The organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil of the Harney soil and high in the subsoil of the Mento soil.

About half of the acreage is used for cultivated crops. These soils are moderately well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About half of the acreage is range. The native vegetation is dominantly big bluestem, sideoats grama, and blue grama. If the range is overgrazed, these grasses are replaced by less desirable plants, such as western ragweed. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

The Harney soil is well suited to dwellings with basements. It is moderately well suited to dwellings without basements and to septic tank absorption fields and sewage lagoons. The shrink-swell potential is a limitation on sites for dwellings without basements. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The moderately slow permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The Mento soil is moderately well suited to dwellings and sewage lagoons. It is poorly suited to septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The slow permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIe. The Harney soil is in the Loamy Upland range site, and the Mento soil is in the Clay Upland range site.

Hg—Heizer-Brownell gravelly loams, 5 to 30 percent slopes. These moderately sloping to steep soils are on upland side slopes dissected by deeply entrenched drainageways. The somewhat excessively drained, shallow Heizer soil is on the steeper, mid slopes directly above areas where limestone crops out. The well drained, moderately deep Brownell soil is on the less sloping, upper side slopes. Individual areas are long and narrow and range from 10 to several hundred acres in size. They are about 60 percent Heizer soil and 25 percent Brownell soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Heizer soil has a surface layer of grayish brown, calcareous gravelly loam about 6 inches thick. The next 3 inches is dark grayish brown, friable, calcareous very channery loam. The substratum is light brownish gray, calcareous very channery loam about 6 inches thick. White, hard limestone is at a depth of about 15 inches.

Typically, the Brownell soil has a surface layer of grayish brown, calcareous gravelly loam about 9 inches thick. The subsoil is light brownish gray, friable, calcareous channery loam about 5 inches thick. The substratum is white, calcareous channery loam about 10 inches thick. White, hard limestone is at a depth of about 24 inches.

Included with these soils in mapping are small areas of Armo and Humbarger soils and limestone outcrops. The deep Armo soils are on foot slopes and side slopes below the Heizer and Brownell soils. The deep Humbarger soils are on flood plains. The limestone outcrops are on steep bluffs below the Heizer and Brownell soils. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the Heizer and Brownell soils. Available water capacity, the organic matter content, and natural fertility are low. Runoff is rapid. Root penetration is restricted by the limestone at a depth of 10 to 20 inches in the Heizer soil and 20 to 40 inches in the Brownell soil.

Most areas are used as range. Because of the hazard of water erosion on both soils and the shallowness to hard limestone in the Heizer soil, these soils are generally unsuited to cultivated crops. They are better

suited to range. The native vegetation is dominantly big bluestem, little bluestem, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as blue grama and hairy grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

The Heizer soil is generally unsuited to building site development. The depth to bedrock is the main limitation.

The Brownell soil is moderately well suited to dwellings without basements and is poorly suited to septic tank absorption fields and sewage lagoons. The depth to bedrock is a limitation affecting all of these uses. Also, the slope and the content of large stones are limitations on sites for dwellings without basements and for sewage lagoons. Buildings without basements should be designed so that they conform to the natural shape of the land. The deeper, less sloping included soils are better suited to building site development.

The land capability classification is VIIs. The Heizer soil is in the Shallow Limy range site, and the Brownell soil is in the Limy Upland range site.

Hm—Holdrege silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on broad ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer also is dark grayish brown silt loam (fig. 8). It is about 4 inches thick. The subsoil is about 18 inches thick. It is friable. The upper part is brown and light yellowish brown silty clay loam, and the lower part is light yellowish brown silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In areas where the upper part of the subsoil has been mixed with the surface soil by tillage, the surface layer is silty clay loam. In places the depth to lime is less than 20 inches.

Included with this soil in mapping are small areas of Carlson, Harney, and Penden soils. Carlson and Harney soils have more clay in the subsoil than the Holdrege soil. Carlson soils are on gently sloping side slopes below the Holdrege soil. Harney soils are in gently sloping areas above the Holdrege soil. Penden soils are loamy and calcareous throughout. They are on side slopes below the Holdrege soil. Included soils make up about 5 percent of the map unit.

Permeability and the organic matter content are moderate in the Holdrege soil. Runoff is medium. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled

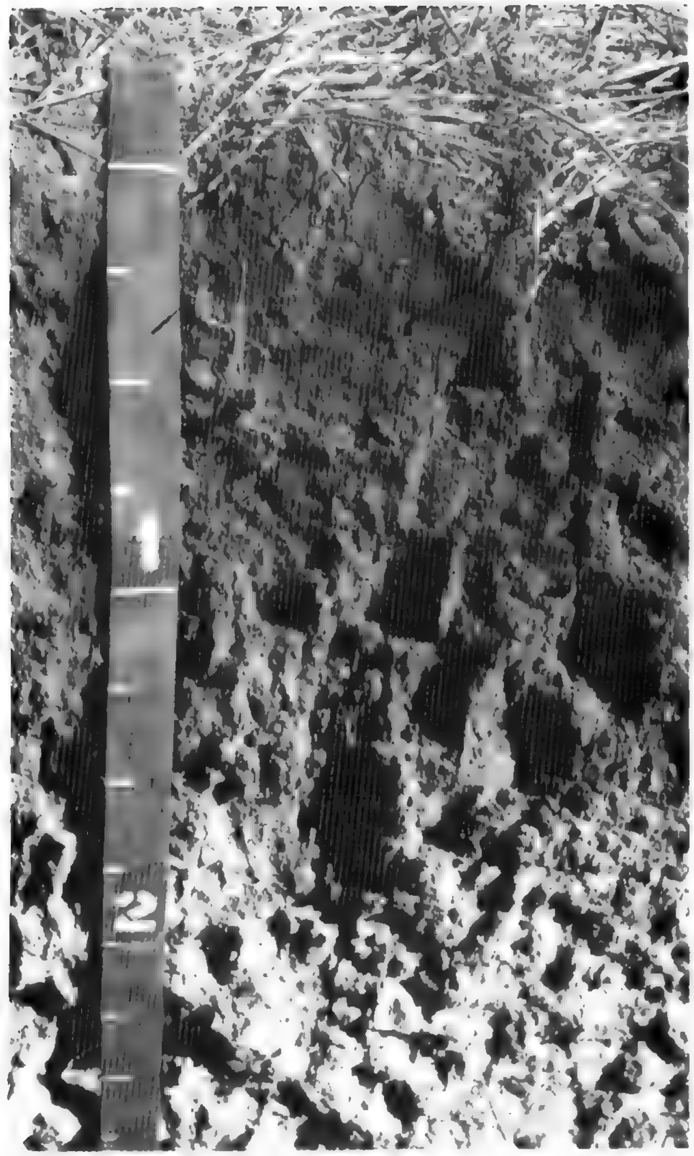

Figure 8.—Profile of Holdrege silt loam, 1 to 3 percent slopes. The surface soil is dark. Depth is marked in feet.

throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

This soil is well suited to septic tank absorption fields. It is moderately well suited to dwellings and sewage lagoons. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Seepage and slope are limitations on sites for sewage lagoons. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIe, and the range site is Loamy Upland.

Ho—Hord silt loam. This deep, nearly level, well drained soil is on stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark gray silt loam about 13 inches thick. The subsoil is about 17 inches thick. It is friable. The upper part is grayish brown silty clay loam, and the lower part is pale brown silt loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In places the depth to calcareous material is less than 20 inches.

Permeability and the organic matter content are moderate. Runoff is slow. Available water capacity and natural fertility are high. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective if the crop residue is managed by stubble mulching or by chemical fallow. The stubble traps snow and thus increases the moisture supply. Returning crop residue to the soil and adding other organic material improve fertility and tilth and increase the rate of water infiltration.

This soil is poorly suited to dwellings and moderately well suited to septic tank absorption fields. The flooding is a hazard affecting both uses. Flood-control structures, such as dikes and levees, are needed. Onsite inspection and knowledge of an area's flooding history are needed when building sites are selected. The soil is only moderately well suited to sewage lagoons because of seepage. Sealing the lagoon helps to overcome this limitation.

The land capability classification is IIc, and the range site is Loamy Terrace.

Hu—Humbarger loam, channeled. This deep, nearly level, well drained soil is on flood plains along small creeks and intermittent drainageways. It is frequently flooded. Individual areas generally are narrow and elongated. They are 160 to 500 feet wide, are 600 to several thousand feet long, and are several hundred acres in size.

Typically, the surface soil is about 28 inches thick. It is calcareous. The upper part is grayish brown loam, and the lower part is dark grayish brown clay loam. The next 5 inches is grayish brown, friable, calcareous clay loam. The substratum is calcareous. The upper part is light brownish gray clay loam, and the lower part to a depth of about 60 inches is light gray gravelly sandy loam. In some areas the surface soil contains more sand.

Permeability and the organic matter content are moderate. Runoff is slow. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate.

Most areas are used as range. Because of the flooding and the difficulty in operating machinery along the meandering stream channels, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly big bluestem, western wheatgrass, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable plants, such as sedges and prairie cordgrass. Recurrent flooding, channeling, and deposition are hazards. Areas near watering facilities and shade trees where livestock congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

The transition areas between cropland and range provide good habitat for upland wildlife, such as quail, deer, rabbits, and numerous songbirds. Planting shrubs in these areas helps to provide winter cover.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is Vw, and the range site is Loamy Lowland.

Hw—Humbarger loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Individual areas are irregular in shape and range from 10 to 120 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The subsurface layer is dark grayish brown, calcareous loam about 14 inches thick. The next 12 inches is grayish brown, friable, calcareous loam. The substratum to a depth of about 60

inches is pale brown, calcareous loam. In places the surface layer is more silty.

Permeability and the organic matter content are moderate. Runoff is slow. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate.

About three-fourths of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, and forage sorghum. If cultivated crops are grown, the flooding is a hazard. It reduces crop yields in some years, but in other years the extra moisture can increase the yields. In years of above average rainfall, the flooding delays planting and harvesting and causes some crop damage. Overcoming the flooding hazard is difficult without major flood-control measures. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About one-fourth of the acreage is range. The native vegetation is dominantly big bluestem, western wheatgrass, and sideoats grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as sedges and prairie cordgrass. Areas near watering facilities and shade trees where livestock congregate are generally overused and in poor condition. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

The transition areas between cropland and range or woodland provide good habitat for many types of wildlife, including deer, quail, and numerous songbirds. Good woodland management can increase the wildlife population.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIw, and the range site is Loamy Lowland.

If—Inavale loamy sand, channeled. This deep, nearly level, excessively drained soil is on flood plains (fig. 9). It is frequently flooded. Individual areas are narrow and elongated. They are 120 to 800 feet wide and are several miles long.

Typically, the surface layer is light gray loamy sand about 6 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous sand.

Permeability is rapid, and runoff is slow. Available water capacity, the organic matter content, and natural fertility are low. The surface layer is loose and should not be tilled when the soil is dry.

Most areas are used as range. Because of the flooding, the low available water capacity, the hazard of soil blowing, and the difficulty in operating machinery along the meandering stream channels, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly sand bluestem, little bluestem, and porcupinegrass. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss, hairy grama, and blue grama. Soil blowing is a hazard in overgrazed areas. Recurrent flooding, channeling, and deposition also are hazards. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is VIw, and the range site is Sandy Lowland.

Mc—McCook silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Individual areas are irregular in shape and range from 80 to 320 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 9 inches thick. The next 10 inches is pale brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In places the surface soil contains more than sand.

Included with this soil in mapping are small areas of the loamy Munjor soils on flood plains along stream channels. Also included are small areas of silty soils on terrace escarpments or on short, steep slopes between stream terraces and flood plains. Included soils make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the McCook soil, and runoff is slow. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa (fig. 10). Inadequate rainfall and flooding are problems if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective if the crop residue is managed by stubble mulching or by chemical fallow. The stubble traps snow and thus increases the moisture supply. Returning crop residue to the soil and adding other organic material improve fertility and tilth and increase the rate of water infiltration.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIw, and the range site is Loamy Lowland.

Figure 9.—An area of Inavale loamy sand, channeled, along the Smoky Hill River.

Mu—Munjor sandy loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is pale brown, calcareous sandy loam about 8 inches thick. The substratum is calcareous. The upper part is light brownish gray sandy loam, the next part is light brownish gray fine sandy loam, and the lower part to a depth of about 60 inches is light gray loamy sand.

Included with this soil in mapping are small areas of the silty McCook soils on the higher parts of the flood plains. These soils make up about 5 percent of the map unit.

Permeability is moderately rapid in the Munjor soil, and runoff is slow. Available water capacity, the organic matter content, and natural fertility are low. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Soil blowing and flooding are hazards if cultivated crops are grown. Also, drought can significantly reduce yields. Wind stripcropping, cropping systems that include grasses or legumes, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

The transition areas between cropland and range or woodland provide good habitat for many types of wildlife,

Figure 10.—Alfalfa in an area of McCook silt loam, occasionally flooded.

such as deer, quail, and numerous songbirds. Good woodland management can increase the wildlife population.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIIw, and the range site is Sandy Lowland.

Pf—Penden clay loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 120 acres in size.

Typically, the surface layer is grayish brown, calcareous clay loam about 10 inches thick. The subsoil is friable, calcareous clay loam about 23 inches thick. The upper part is brown, the next part is pale brown, and the lower part is very pale brown (fig. 11). The substratum to a depth of about 60 inches is very pale brown, calcareous clay loam. In some places the surface layer does not contain lime. In other places hard caliche is within a depth of 40 inches.

Included with this soil in mapping are small areas of Carlson and Uly soils. Carlson soils have more clay in the subsoil than the Penden soil. They are on gently sloping ridgetops. The silty Uly soils are on side slopes above the Penden soil. Also included are soils that have a gravelly surface layer. These soils are on ridgetops above the Penden soil. Included soils make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the Penden soil. Available water capacity is high. Runoff and natural fertility are medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

About half of the acreage is used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of

Figure 11.—Profile of Penden clay loam, 3 to 7 percent slopes. The light colored part of the profile has an accumulation of lime. Depth is marked in feet.

conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About half of the acreage is range. The native vegetation is dominantly big bluestem, little bluestem, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss and blue grama. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

This soil is moderately well suited to dwellings, septic tank absorption fields, and sewage lagoons. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Slope and seepage are limitations on sites for sewage lagoons. Some land shaping commonly is needed to overcome the slope. Seepage can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIIe, and the range site is Limy Upland.

Pk—Penden clay loam, 3 to 7 percent slopes, eroded. This deep, moderate sloping, well drained soil is on side slopes in the uplands. Sheet erosion has removed more than half of the original surface layer in most places. In a few places, the subsoil is exposed and there are some rills and shallow gullies that can be crossed by farm equipment. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is pale brown, calcareous clay loam about 5 inches thick. The subsoil is very pale brown, friable, calcareous clay loam about 25 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous clay loam.

Included with this soil in mapping are small areas of Carlson and Coly soils. Carlson soils have more clay in the subsoil than the Penden soil. They are on gently sloping ridgetops. The silty Coly soils are on side slopes above the Penden soil. Included soils make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the Penden soil. Available water capacity is high. Runoff and natural fertility are medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is poorly suited to wheat, grain sorghum, and forage sorghum. Further water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to

the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

The transition areas between cropland and range provide good habitat for upland wildlife, such as pheasants. Planting shrubs in these areas helps to provide winter cover.

This soil is moderately well suited to dwellings, septic tank absorption fields, and sewage lagoons. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Slope and seepage are limitations on sites for sewage lagoons. Some land shaping commonly is needed to overcome the slope. Seepage can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IVe, and the range site is Limy Upland.

Po—Penden loam, 7 to 15 percent slopes. This deep, strongly sloping, well drained soil is on upland side slopes dissected by deeply entrenched drainageways. Individual areas are irregular in shape and range from 40 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 8 inches thick. The subsurface layer is grayish brown, calcareous loam about 6 inches thick. The subsoil is very pale brown, friable, calcareous loam about 18 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous loam. In places hard caliche is within a depth of 40 inches.

Included with this soil in mapping are small areas of Canlon, Humbarger, and Uly soils and rock outcrops. The moderately deep Campus and shallow Canlon soils are on side slopes below the Penden soil. Humbarger soils are on flood plains. The silty Uly soils are on side slopes above the Penden soil. The rock outcrops are on steep slopes below the Penden soil. Included areas make up about 10 percent of the map unit.

Permeability and the organic matter content are moderate in the Penden soil. Runoff is rapid. Available water capacity is high. Natural fertility is medium. The shrink-swell potential is moderate in the subsoil.

Most areas are used as range. Because of the hazard of water erosion, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly big bluestem, little bluestem, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss, blue grama, and tall dropseed. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

Mainly because of the slope, this soil is only moderately well suited to dwellings and septic tank absorption fields and is poorly suited to sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. The lateral lines in septic tank absorption fields should be installed on the contour. If the less sloping areas are selected as sites for sewage lagoons, less leveling and banking will be needed during construction. The shrink-swell potential is a limitation on building sites. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil.

The land capability classification is VIe, and the range site is Limy Upland.

Rf—Roxbury silt loam. This deep, nearly level, well drained soil is on flood plains. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to 320 acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is dark grayish brown, calcareous silt loam about 19 inches thick. The next 5 inches is light brownish gray, friable, calcareous silt loam. The substratum to a depth of about 60 inches is calcareous silt loam. The upper part is light gray, and the lower part is very pale brown. In places the dark surface soil is less than 20 inches thick.

Permeability and the organic matter content are moderate. Runoff is slow. Available water capacity and natural fertility are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate below the surface soil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective if the crop residue is managed by stubble mulching or by chemical fallow. The stubble traps snow and thus increases the moisture supply. Returning crop residue to the soil and adding other organic material improve fertility and tilth and increase the rate of water infiltration.

This soil is poorly suited to dwellings and moderately well suited to septic tank absorption fields. The flooding is a hazard affecting both uses. Flood-control structures, such as dikes and levees, are needed. Onsite inspection and knowledge of an area's flooding history are needed

when building sites are selected. This soil is only moderately well suited to sewage lagoons because of seepage. Sealing the lagoon helps to overcome this limitation.

The land capability classification is IIc, and the range site is Loamy Terrace.

Ub—Uly silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 10 inches thick (fig. 12). The subsoil is friable, calcareous silt loam about 10 inches thick. The upper part is brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In places the content of clay is higher in the subsoil.

Included with this soil in mapping are small areas of the loamy Armo soils. These soils are in gently sloping areas below the Uly soil. They make up about 5 percent of the map unit.

Permeability and the organic matter content are moderate in the Uly soil. Available water capacity is high. Runoff and natural fertility are medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About two-thirds of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces (fig. 13), grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About one-third of the acreage is range. The native vegetation is dominantly big bluestem, little bluestem, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss, blue grama, and tall dropseed. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIe, and the range site is Loamy Upland.

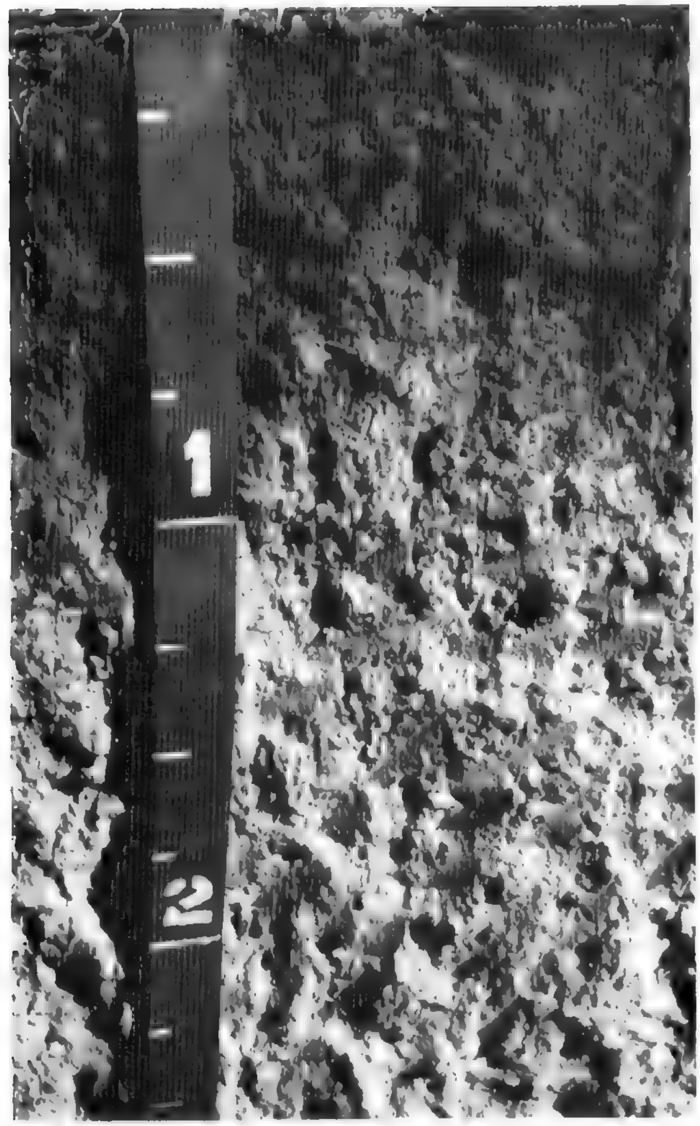

Figure 12.—Profile of Uly silt loam, 1 to 3 percent slopes. The dark surface layer is about 10 inches thick. Depth is marked in feet.

Uc—Uly silt loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 320 acres in size.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is about 14 inches thick. It is friable. The upper part is brown silty clay loam, and the lower part is pale brown, calcareous silt loam. The substratum to a depth of about 60 inches is light yellowish brown, calcareous silt loam. In some eroded areas, the depth to lime is less than 10 inches and the

Figure 13.—Terraces in an area of Uly silt loam, 1 to 3 percent slopes.

surface layer is silty clay loam. In places the content of clay is higher in the subsoil.

Included with this soil in mapping are small areas of the loamy Penden soils. These soils are on side slopes below the Uly soil. They make up about 5 percent of the map unit.

Permeability and the organic matter content are moderate in the Uly soil. Available water capacity is high. Runoff and natural fertility are medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About one-fourth of the acreage is used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

About three-fourths of the acreage is range. The native vegetation is dominantly big bluestem, little bluestem, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as buffalograss, blue grama, and tall dropseed. Water erosion is a hazard in overgrazed areas. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a scheduled deferment of grazing during the growing season, and a uniform distribution of grazing helps to keep the range productive.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to

sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is IIIe, and the range site is Loamy Upland.

Vo—Voda silty clay loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on the flood plain adjacent to Cedar Bluff Reservoir. It occurs as one long and narrow area about 3,700 acres in size. Most of the area was previously covered by water from the reservoir.

Typically, the surface layer is grayish brown, calcareous silty clay loam about 7 inches thick. The substratum is mottled and calcareous. The upper part is gray silty clay, and the lower part to a depth of about 60 inches is light brownish gray silt loam.

Included with this soil in mapping are small areas of the well drained McCook and Munjor soils. These soils are higher on the landscape than the Voda soil. Also included are poorly drained soils that have a sandy substratum or that are silty throughout. These soils generally have a water table near the surface and are lower on the landscape than the Voda soil. Included soils make up about 15 percent of the map unit.

Permeability is slow in the upper part of the substratum in the Voda soil and moderate in the lower part. Runoff is slow. Natural fertility and available water capacity are high. The organic matter content is moderate. The shrink-swell potential is high. A seasonal high water table is at a depth of about 0.5 foot to 3.0 feet in spring and summer.

Most areas are used as wildlife habitat. The vegetation is dominantly cottonwood, tamarisk, willows, and smartweed. A few areas are used for cultivated crops.

This soil is well suited to wheat, grain sorghum, and forage sorghum. If cultivated crops are grown, the flooding is a hazard. It reduces crop yields in some years, but in other years the extra moisture can increase the yields. In years of above average rainfall, the flooding delays planting and harvesting and causes crop damage. Overcoming the flooding is difficult without major flood-control measures. Returning crop residue to the soil and adding organic material improve tilth and fertility and increase the rate of water infiltration.

This soil is generally unsuited to building site development because of the flooding and the wetness. Overcoming the flooding hazard is difficult without major flood-control measures.

The land capability classification is IIw, and the range site is Clay Lowland.

Wb—Wakeen silt loam, 1 to 3 percent slopes. This moderately deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Individual areas are irregular in shape an range from 20 to 80 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 11 inches thick. The subsoil is friable, calcareous silty clay loam about 19 inches thick. The upper part is pale brown, and the lower part is white. Chalky limestone is at a depth of about 30 inches.

Included with this soil in mapping are small areas of Armo and Brownell soils. The deep, loamy Armo soils are on foot slopes and the lower side slopes. The loamy Brownell soils are on the lower side slopes. Included soils make up about 15 percent of the map unit.

Permeability, available water capacity, and the organic matter content are moderate in the Wakeen soil. Runoff and natural fertility are medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. Root penetration is restricted by the chalk bedrock at a depth of 20 to 40 inches. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and forage sorghum. Water erosion is a hazard if cultivated crops are grown. Terraces, contour farming, grassed waterways, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

This soil is moderately well suited to dwellings and is poorly suited to septic tank absorption fields and sewage lagoons. The depth to bedrock is a limitation affecting all of these uses. Also, the shrink-swell potential is a limitation on sites for dwellings, and seepage is a limitation on sites for septic tank absorption fields and sewage lagoons. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Because of seepage, the floor and walls of sewage lagoons should be sealed. The deeper included soils are better suited to building site development.

The land capability classification is IIIe, and the range site is Limy Upland.

Wp—Wakeen-Nibson silt loams, 3 to 8 percent slopes. These moderately sloping soils are on side slopes and the tops of ridges in the uplands. The moderately deep, well drained Wakeen soil is on ridgetops and the upper side slopes. The shallow, somewhat excessively drained Nibson soil is on the lower side slopes. Individual areas are irregular in shape and range from 20 to 120 acres in size. They are about 65 percent Wakeen soil and 20 percent Nibson soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Wakeen soil has a surface layer of grayish brown, calcareous silt loam about 4 inches thick.

The subsurface layer is grayish brown, calcareous silty clay loam about 7 inches thick. The subsoil is friable, calcareous silty clay loam about 11 inches thick. The upper part is light yellowish brown, and the lower part is pale yellow. The substratum is white, calcareous silt loam about 11 inches thick. Chalky limestone is at a depth of about 33 inches.

Typically, the Nibson soil has a surface layer of light brownish gray, calcareous silt loam about 6 inches thick. The subsoil is very pale brown, friable, calcareous silty clay loam about 5 inches thick. The substratum is white, calcareous silty clay loam about 3 inches thick. Chalky limestone is at a depth of about 14 inches.

Included with these soils in mapping are small areas of the deep, loamy Armo and Penden soils and small areas where chalk and shale crops out on side slopes. Armo soils are on foot slopes and the lower side slopes. Penden soils are on the upper side slopes. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the Wakeen and Nibson soils, and runoff is medium. Available water capacity and the organic matter content are moderate in the Wakeen soil and low in the Nibson soil. Natural fertility is medium in the Wakeen soil and low in the Nibson soil. Root penetration is restricted by the bedrock at a depth of 20 to 40 inches in the Wakeen soil and 10 to 20 inches in the Nibson soil. The shrink-swell potential is moderate in the subsoil of both soils.

Most of the acreage is used for cultivated crops. These soils are poorly suited to wheat, grain sorghum, and forage sorghum. Yields are significantly reduced on the Nibson soil because of the low available water capacity and the shallowness to bedrock. If cultivated crops are grown, water erosion is a hazard on both soils. Terraces, contour farming, grassed waterways, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Returning crop residue to the soil and adding other organic material improve tilth and fertility and increase the rate of water infiltration.

The Wakeen soil is moderately well suited to dwellings and is poorly suited to septic tank absorption fields and sewage lagoons. The depth to bedrock is a limitation affecting all of these uses. Also, the shrink-swell potential is a limitation on sites for dwellings, and seepage is a limitation on sites for septic tank absorption fields and sewage lagoons. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Because of seepage, the floor and walls of sewage lagoons should be sealed. The deeper included soils are better suited to building site development.

The Nibson soil is generally unsuited to building site development because of the depth to bedrock.

The land capability classification is IVe, and the range site is Limy Upland.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 7 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 373,552 acres in the survey area, or nearly 65 percent of the total acreage, meets the soil requirements for prime farmland. This land is throughout the county. Most of the prime farmland is cropland, some of which is irrigated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to a capability classification and a range site at the end of each map unit description and in tables 6 and 7. The capability classification and range site for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops

Jerry B. Lee, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 327,000 acres in Trego County, or 57 percent of the total acreage, is used for cultivated crops or is summer fallowed. During the period 1973 to 1983, wheat was grown on about 57 percent of the cropland (fig. 14); grain sorghum on 6 percent; and corn, alfalfa, and sunflowers on 1 percent (*3*). About 36 percent of the cropland was summer fallowed.

The main concerns in managing the soils in Trego County for cultivated crops are controlling water erosion and soil blowing, making the most efficient use of the available water, and maintaining fertility and tilth.

Water erosion is the major hazard on about 70 percent of the cropland. It occurs mainly on soils that have a slope of more than 1 or 2 percent. Examples are Armo, Coly, Holdrege, Penden, Uly, and Wakeen soils. Unless the surface is protected by a crop or crop residue, soil blowing is a hazard on Dorrance and Munjor soils, which typically have a surface layer of sandy loam.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Secondly, erosion results in the pollution of streams by sediments, nutrients, and pesticides. Control of erosion minimizes this pollution and improves the quality of water.

Erosion-control measures provide a protective cover, reduce the runoff rate, and increase the rate of water

Figure 14.—Harvesting wheat in an area of Uly silt loam, 1 to 3 percent slopes.

infiltration. A cropping system that keeps a plant cover on the surface for extended periods helps to control erosion and preserves the productive capacity of the soils.

Conservation tillage and conservation cropping systems help to control water erosion and soil blowing. A system of conservation tillage leaves all or part of the crop residue on the surface. Examples are stubble mulching and chemical fallow. When these systems are applied, the stubble of crops or crop residue is left essentially in place to provide a protective cover before and during the preparation of a seedbed and at least a partial cover for the succeeding crop. Drilled crops, such as small grain, are alternated with row crops in a conservation cropping system. Wind stripcropping, or the production of crops in relatively narrow strips perpendicular to the direction of the prevailing wind, helps to control soil blowing.

Terraces, diversions, grassed waterways, and contour farming are needed in combination with conservation tillage on soils that have a slope of more than 2 percent. If a system of conservation tillage is not applied, they also are needed on soils that have a slope of more than 1 percent. Terraces and diversions help to control water erosion by shortening the length of slopes and reducing the runoff rate. They are most practical on deep, well drained soils that have uniform slopes. Contour farming should generally be used in combination with terraces (fig. 15). It is best suited to soils that have smooth, uniform slopes and are suitable for terracing.

Figure 15.—Contour farming and terraces in an area of Uly silt loam, 3 to 6 percent slopes.

Inadequate rainfall usually is a problem on all of the cropland in the county. As a result, the supply of water stored in the soil should to be conserved or increased by summer fallowing and terracing. Summer fallowing allows the soil to store moisture during the summer for the growth of succeeding crops. Most of the fallowed cropland in the county is in a wheat-sorghum-fallow or wheat-fallow-wheat rotation. Summer fallowing is most effective when the crop residue is managed by stubble mulching or by chemical fallow. The stubble traps snow and thus increases the moisture supply. Both stubble mulching and terracing reduce the runoff rate.

Organic matter is a storehouse of available plant nutrients. It increases the rate of water intake, helps to prevent surface crusting, helps to control erosion, and improves tilth. Most of the soils in the county that are used for crops have a surface layer of silt loam. A surface crust forms during periods of heavy rainfall. When dry, the crusted surface is nearly impervious to water. As a result, the runoff rate is increased. Regularly adding organic material and leaving crop residue on the surface help to prevent excessive crusting, increase the rate of water infiltration, and reduce the runoff rate and the hazard of erosion.

Plants on most of the arable soils in the county respond well to applications of nitrate and phosphate fertilizer. On all soils the amount of fertilizer to be applied should be based on the results of soil tests, on the needs of the crop, on the expected level of yields, and on the experience of farmers. The Cooperative Extension Service can help to determine the kind and amount of fertilizer needed.

Information about the design of erosion-control practices is available in the local office of the Soil

Conservation Service. The latest information about growing crops can be obtained from the Cooperative Extension Service or the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and in the section "Interpretive Groups."

Rangeland

Loren J. Pearson, range conservationist, Soil Conservation Service, helped prepare this section.

About 230,000 acres in Trego County, or nearly 40 percent of the total acreage, is range. Areas of range are throughout the county, generally adjacent to

drainageways and on the steeper slopes that cannot be easily farmed. About 36,000 head of livestock utilize the range resource each year (*3*). Cow-calf enterprises are dominant, but some ranchers operate stocker enterprises. Also, several hundred head are full-fed each year. The native range is well suited to these livestock enterprises.

The grass species in the areas of range are essentially the same as those of 100 years ago. Changes in the plant community result from environmental changes or cultural influences. Proper grazing management can increase productivity.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Nearly all of the livestock management programs in the county rely on native range for summer grazing from the middle of May through late in October. In mid-August the protein levels of native grasses begin to drop below the daily requirements of the livestock. Protein supplements are needed during this period. A scheduled deferment of grazing during the growing season allows the plants to regain vigor. Numerous variations of this system can be used in nearly every livestock program. Well distributed watering facilities help to achieve a uniform distribution of grazing (fig. 16).

Native Woodland, Windbreaks, and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

The native woodland in Trego County is in upland drainageways and along the major streams and rivers. The wooded areas occur only as narrow bands or strips. The trees in these areas can be used for firewood and other wood products, but they are not in large enough concentrations to be of commercial value.

Eastern cottonwood and peachleaf willow are the dominant species along the Smoky Hill and Saline Rivers. The dominant species along Big Creek are boxelder, green ash, American elm, and peachleaf willow. In areas along this creek, eastern cottonwood is more prevalent in the eastern part of the county than in the western part. Other species include red mulberry, hackberry, black walnut, honeylocust, American plum,

Figure 16.—An area of Penden loam, 7 to 15 percent slopes, used as range. The windmill provides livestock water.

and golden currant. The understory is mainly green ash, hackberry, and boxelder.

Upland drainageways support trees mainly in their lower reaches. Eastern cottonwood and peachleaf willow are the dominant species. Other species include green ash, boxelder, red mulberry, American elm, honeylocust, American plum, Siberian elm, and golden currant.

Trees grow on most of the farmsteads and ranch headquarters in Trego County. Some are windbreaks, but most are environmental or ornamental plantings. Only a few shelterbelts and field windbreaks are grown in the county. Windbreaks that protect livestock are numerous. They are an important part of the livestock industry.

The dominant species in old plantings generally are eastern redcedar and Siberian elm. In some areas, however, eastern cottonwood was planted extensively. New windbreaks consist mainly of eastern redcedar, Rocky Mountain juniper, honeylocust, and lilac. Other commonly planted species are ponderosa pine, Austrian pine, Scotch pine, cotoneaster, Russian-olive, tamarisk, green ash, hackberry, Russian mulberry, and oriental arborvitae.

Tree planting is a continual need because old trees pass maturity and deteriorate, because some trees are destroyed by insects, disease, or storms, and because new plantings are needed on expanding farmsteads. Renovation measures, such as removal and replacement or supplemental planting, help to maintain the effectiveness of the windbreak.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the soils on the site should be suited to the trees and shrubs selected for planting. Permeability, available water capacity, fertility, soil depth, and soil texture greatly affect the growth rate.

Establishing trees and shrubs is difficult in Trego County. The moisture supply is usually short during the growing season, and hot, drying winds are common. Unsuccessful windbreaks and environmental plantings result mainly from dry conditions and competition from weeds and grasses. Proper site preparation before planting and control of competing vegetation after planting are important concerns in establishing and maintaining a windbreak. Supplemental watering is needed during dry periods, and cover crops are needed to protect the surface from hot winds.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Cedar Bluff Reservoir attracts many visitors from northwest Kansas. It has facilities for camping, picnicking, swimming, boating, and fishing. The scenic countryside of the county offers broad views of cropland, rolling grassland, and rocky bluffs. The pheasant hunting season attracts many hunters to the county.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are

not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Trego County are pheasant, bobwhite quail, cottontail rabbit, white-tailed deer, and mule deer. Mourning doves, fox squirrels, and wild turkeys are hunted on a limited basis. Waterfowl hunting is a popular activity on the Cedar Bluff Reservoir. Some coyotes, raccoons, and opossum are trapped in the county.

Nongame species are numerous because of the diversity of habitat types. Cropland, grassland, and some woodland are interspersed throughout the county. Each of these provides habitat for a particular group of species. The transition zone, or edge, between these habitat types is an important part of the habitat. A good windbreak often provides winter cover for several pheasants and cottontails, a covey of quail, and many songbirds.

Cedar Bluff Reservoir and farm ponds provide fair to good fishing. The species commonly caught are channel cat, flathead catfish, bullhead catfish, bluegill, largemouth bass, white bass, walleye, and crappie.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, grain sorghum, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestems, grama, switchgrass, sunflowers, ragweed, goldenrod, and wheatgrass.

Shrubs are bushy woody plants that produce fruit, seed, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are sandbar willow, currant, plum, prairie rose, smooth sumac, and fragrant sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include pheasant, meadowlark, field sparrow, and cottontail rabbit.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include mule deer, prairie chickens, hawks, prairie dogs, and meadowlarks.

Technical assistance in planning wildlife areas and in determining the vegetation suitable for planting can be obtained from the Soil Conservation Service. Additional information and assistance can be obtained from the Kansas Fish and Game Commission and from the Cooperative Extension Service.

Engineering

John Eberwein, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to

bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on

the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and

fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock, affect the

construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 17). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

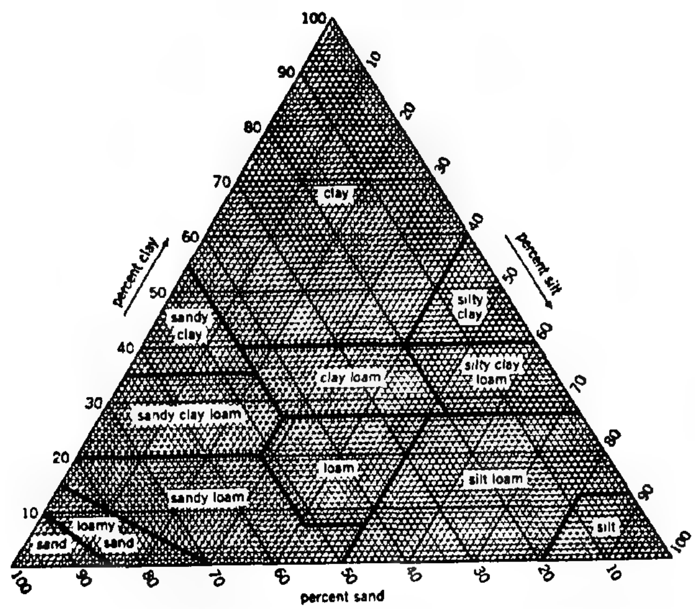

Figure 17.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content

of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay

minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or

soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17. Only saturated zones within a depth of about 6 feet are indicated. An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Kansas Department of Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*4*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*5*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Armo Series

The Armo series consists of deep, well drained, moderately permeable soils on foot slopes and the lower side slopes in the uplands. These soils formed in calcareous, loamy colluvial sediments weathered from chalk. Slopes range from 1 to 15 percent.

Armo soils are commonly adjacent to Brownell, Heizer, Humbarger, Nibson, and Wakeen soils. The moderately deep Brownell soils and the shallow Heizer soils are on side slopes above or below the Armo soils. Humbarger soils have a mollic epipedon that is more than 20 inches thick. They are on flood plains. The shallow Nibson soils

are on side slopes. The moderately deep Wakeen soils are higher on the landscape than the Armo soils.

Typical pedon of Armo loam, 7 to 15 percent slopes, 1,900 feet south and 1,100 feet east of the northwest corner of sec. 4, T. 15 S., R. 23 W.

A1—0 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

A2—10 to 16 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable; many fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

Bw—16 to 30 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

BCk—30 to 38 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; slightly hard, friable; many masses of lime; many limestone fragments; violent effervescence; moderately alkaline; clear smooth boundary.

C—38 to 60 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; about 5 percent chalky shale fragments; few threads of lime; violent effervescence; moderately alkaline.

The mollic epipedon ranges from 7 to 20 inches in thickness. The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It typically is loam, but in some pedons it is silt loam. It typically is mildly alkaline but ranges from neutral to moderately alkaline. The B horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is clay loam, silty clay loam, or loam. It is mildly alkaline or moderately alkaline. The C horizon has colors similar to those of the B horizon. It is loam, silt loam, or clay loam. The content of chalk fragments 0.5 millimeter to 1 inch in diameter ranges from 0 to 10 percent in this horizon.

Bogue Series

The Bogue series consists of moderately deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in material weathered from acid, fissile shale. Slopes range from 8 to 25 percent.

Bogue soils are commonly adjacent to Brownell, Dorrance, and Heizer soils. The adjacent soils have less clay throughout than the Bogue soils. The moderately deep Brownell and shallow Heizer soils are higher on the landscape than the Bogue soils. The loamy Dorrance soils are on side slopes above the Bogue soils.

Typical pedon of Bogue clay, 8 to 25 percent slopes, 1,200 feet east and 25 feet south of the northwest corner of sec. 12, T. 15 S., R. 21 W.

A—0 to 6 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak medium subangular blocky structure; hard, firm; many fine roots; neutral; clear smooth boundary.

Bw—6 to 19 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; many fine faint olive (5Y 5/3) mottles; strong medium subangular blocky structure; extremely hard, extremely firm; few fine roots; few intersecting slickensides; about 14 percent fine fragments of calcite or chalk; slight effervescence; mildly alkaline; clear smooth boundary.

C—19 to 27 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; strong medium subangular blocky structure; extremely hard, extremely firm; few very fine roots; common fine fragments of calcite or chalk; neutral; abrupt smooth boundary.

Cr—27 to 40 inches; dark gray (5Y 4/1), clayey shale, very dark gray (5Y 3/1) moist.

The thickness of the solum ranges from 12 to 23 inches. The depth to fissile shale ranges from 20 to 40 inches. The depth to carbonates varies, but the carbonates are in the solum of all pedons and are in the form of chalk fragments.

The A horizon has value of 4 to 7 (3 to 5 moist). It is typically clay, but in some pedons it is silty clay. It is typically neutral or mildly alkaline but ranges from neutral to moderately alkaline. The Bw horizon has hue of 2.5Y or 5Y or is neutral in hue. It has value of 4 to 7 (3 to 5 moist) and chroma of 0 or 1. It ranges from neutral to moderately alkaline. The C horizon has hue of 2.5Y or 5Y or is neutral in hue. It has value of 3 to 6 (2 to 4 moist) and chroma of 0 to 3. It ranges from very strongly acid to neutral.

Brownell Series

The Brownell series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from chalky limestone. Slopes range from 2 to 15 percent.

Brownell soils are commonly adjacent to Armo, Heizer, and Mento soils. The deep Armo soils are on side slopes above the Brownell soils. Also, they are on foot slopes below the Brownell soils. The shallow Heizer soils are on side slopes below the Brownell soils. The deep Mento soils are in gently sloping areas above the Brownell soils.

Typical pedon of Brownell gravelly loam, 2 to 10 percent slopes, 2,000 feet north and 150 feet west of the southeast corner of sec. 25, T. 14 S., R. 23 W.

A—0 to 8 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

Bw—8 to 12 inches; grayish brown (10YR 5/2) very channery loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; about 40 percent limestone fragments 0.5 inch to 3.0 inches in size along the longer axis; violent effervescence; moderately alkaline; clear smooth boundary.

C—12 to 28 inches; white (10YR 8/2) very channery loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; few fine roots; about 40 percent limestone fragments 0.5 inch to 6.0 inches in size along the longer axis; violent effervescence; moderately alkaline; clear smooth boundary.

R—28 inches; hard, chalky limestone.

The thickness of the solum ranges from 10 to 24 inches. The depth to limestone bedrock ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It typically is gravelly loam, but in some pedons it is loam. The Bw horizon has value of 3 to 6 (2 to 4 moist) and chroma of 1 to 3. It is very gravelly loam or very channery loam. The content of limestone fragments 0.5 inch to 3.0 inches in size along the longer axis ranges from 35 to 50 percent in this horizon. The C horizon has value of 6 to 8 (5 to 8 moist) and chroma of 1 to 4. It is very channery loam or very gravelly loam. The content of limestone fragments 0.5 to 6.0 inches in size along the longer axis ranges from 35 to 60 percent.

Campus Series

The Campus series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy material weathered from caliche. Slopes range from 6 to 15 percent.

Campus soils are similar to Penden soils and are commonly adjacent to Canlon, Penden, and Wakeen soils. The shallow Canlon soils are on the steeper side slopes below the Campus soils. The deep Penden soils are higher on the landscape than the Campus soils. The silty Wakeen soils are lower on the landscape than the Campus soils.

Typical pedon of Campus loam, in an area of Campus-Canlon loams, 6 to 30 percent slopes; 1,300 feet north and 600 feet east of the southwest corner of sec. 24, T. 15 S., R. 21 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; about 10 percent fine and medium caliche fragments; strong effervescence; moderately alkaline; clear smooth boundary.

Bw—7 to 14 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; many fine roots; about 10 percent fine and medium caliche fragments; violent effervescence; moderately alkaline; clear smooth boundary.

BCk—14 to 36 inches; white (10YR 8/2) loam, light gray (10YR 7/2) moist; massive; hard, firm; few fine roots; soft, powdery lime; about 14 percent medium caliche fragments; violent effervescence; moderately alkaline; clear smooth boundary.

R—36 inches; white, hard caliche.

The mollic epipedon ranges from 7 to 20 inches in thickness. The solum is mildly alkaline or moderately alkaline. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is typically loam, but the range includes clay loam and silty clay loam. The B horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 to 4. It is loam or clay loam.

Canlon Series

The Canlon series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from limy sandstone or caliche. Slopes range from 6 to 30 percent.

Canlon soils are commonly adjacent to Campus and Wakeen soils. The moderately deep Campus soils are on side slopes above the Canlon soils. The silty, moderately deep Wakeen soils are lower on the landscape than the Canlon soils.

Typical pedon of Canlon loam, in an area of Campus-Canlon loams, 6 to 30 percent slopes; 700 feet north and 400 feet east of the southwest corner of sec. 24, T. 15 S., R. 22 W.

A—0 to 5 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; about 10 percent fine and medium caliche pebbles; violent effervescence; moderately alkaline; clear smooth boundary.

AC—5 to 8 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; about 10 percent fine to coarse caliche fragments; violent effervescence; moderately alkaline; clear smooth boundary.

C—8 to 18 inches; white (10YR 8/2) gravelly loam, very pale brown (10YR 7/3) moist; massive; hard, firm; few fine roots; about 34 percent calcium carbonate

fragments (mainly caliche) 2 millimeters to 3 inches in diameter; violent effervescence; moderately alkaline; abrupt smooth boundary.

R—18 inches; white, hard caliche.

The solum is 3 to 12 inches thick. The depth to bedrock ranges from 10 to 20 inches. The content of caliche fragments less than 3 inches in diameter is 5 to 14 percent throughout the solum and ranges to about 34 percent in the C horizon. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 to 4.

Carlson Series

The Carlson series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loess and in the underlying calcareous old alluvium. Slopes range from 1 to 3 percent.

Carlson soils are similar to Harney and Mento soils and are commonly adjacent to Holdrege and Penden soils. Harney and Mento soils do not have old alluvial sediments within a depth of 40 inches. Harney soils are higher on the landscape than the Carlson soils, and Mento soils are lower on the landscape. Holdrege soils have less clay in the subsoil than the Carlson soils. Also, they are higher on the landscape. The loamy Penden soils are lower on the landscape than the Carlson soils.

Typical pedon of Carlson silt loam, 1 to 3 percent slopes, 1,800 feet west and 150 feet south of the northeast corner of sec. 36, T. 11 S., R. 21 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

A—4 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; neutral; clear smooth boundary.

Bt—12 to 20 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; few faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

Btk—20 to 24 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; few faint clay films on faces of peds; few small fragments; few masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

2Bk—24 to 40 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; weak fine granular structure; slightly hard, friable; many fine roots; many fine tubular pores; many threads and common masses of lime; violent effervescence, moderately alkaline; clear smooth boundary.

2C—40 to 60 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; weak coarse prismatic structure; slightly hard, friable; about 2 percent fine fragments; few threads and soft masses of lime; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to free carbonates ranges from 12 to 24 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but in some pedons it is loam, clay loam, or silty clay loam. It typically is neutral or mildly alkaline but ranges from slightly acid to mildly alkaline. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 to 4. It is silty clay loam, clay loam, or silty clay. It typically is mildly alkaline or moderately alkaline but ranges from neutral to moderately alkaline. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 to 4. It is dominantly clay loam or loam. In some pedons, however, it is sandy loam below a depth of 40 inches.

Coly Series

The Coly series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 6 percent.

Coly soils are similar to Uly soils and are commonly adjacent to Holdrege, Penden, and Uly soils. The adjacent soils have a mollic epipedon. Holdrege soils are higher on the landscape than the Coly soils. Penden soils are on side slopes below the Coly soils. Uly soils are in positions on the landscape similar to those of the Coly soils.

Typical pedon of Coly silt loam, 2 to 6 percent slopes, 800 feet west and 800 feet north of the southeast corner of sec. 9, T. 11 S., R. 24 W.

Ap—0 to 4 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, friable; many fine roots; many tubular pores; slight effervescence; moderately alkaline; clear smooth boundary.

AC—4 to 8 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; moderate medium granular structure; slightly hard, friable; common fine roots; many fine tubular pores; few soft masses of lime; slight effervescence; moderately alkaline; clear smooth boundary.

C—8 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; few fine roots; few threads of lime; few fine

tubular pores; strong effervescence; moderately alkaline.

Typically, free carbonates are at the surface, but in some pedons they are leached from the upper 3 inches. The soils are mildly alkaline or moderately alkaline throughout. The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. The AC and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. They have visible films, masses, and threads of carbonate.

Dorrance Series

The Dorrance series consists of deep, excessively drained soils on uplands. These soils formed in loamy material underlain by sandy and gravelly sediments. Permeability is moderately rapid in the surface layer and very rapid in the substratum. Slopes range from 3 to 15 percent.

Dorrance soils are commonly adjacent to Bogue and Munjor soils. The adjacent soils have less sand throughout than the Dorrance soils. Also, Bogue soils have more clay throughout. They are on the lower side slopes. Munjor soils are on flood plains.

Typical pedon of Dorrance sandy loam, 3 to 15 percent slopes, 700 feet east and 100 feet south of the northwest corner of sec. 3, T. 15 S., R. 25 W.

A—0 to 11 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; about 14 percent pebbles 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; clear smooth boundary.

AC—11 to 16 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; slightly hard, friable; common fine roots; about 15 percent pebbles 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; clear smooth boundary.

C1—16 to 26 inches; very pale brown (10YR 7/3) gravelly loamy sand, light yellowish brown (10YR 6/4) moist; weak fine granular structure; soft, very friable; about 20 percent pebbles 2 to 5 millimeters in diameter; violent effervescence; moderately alkaline; clear smooth boundary.

C2—26 to 60 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; loose; about 34 percent pebbles 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 24 inches. The depth to lime is 0 to 10 inches. The mollic epipedon is 7 to 19 inches thick. The content of quartz pebbles ranges from 5 to 34 percent throughout the profile.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It typically is sandy loam, but in some pedons it is gravelly sandy loam. It ranges from neutral to moderately alkaline. The AC and C horizons are mildly alkaline or moderately alkaline. The AC horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It typically is gravelly sandy loam, but in some pedons it is sandy loam, loamy sand, or gravelly loamy sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4.

Harney Series

The Harney series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 3 percent.

Harney soils are similar to Carlson and Mento soils and are commonly adjacent to Holdrege, Mento, and Uly soils. Carlson soils have old alluvial sediments within a depth of 40 inches. They are lower on the landscape than the Harney soils. Holdrege soils have less clay in the subsoil than the Harney soils. Also, they are lower on the landscape. Mento soils have an abrupt boundary between the A and Bt horizons. They are lower on the landscape than the Harney soils. Uly soils do not have an argillic horizon. They are on side slopes below the Harney soils.

Typical pedon of Harney silt loam, 0 to 1 percent slopes, 2,500 feet east and 1,900 feet north of the southwest corner of sec. 33, T. 11 S., R. 23 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; slightly acid; clear smooth boundary.

AB—5 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; neutral; clear smooth boundary.

Bt1—11 to 17 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; common faint clay films on faces of peds; neutral; clear smooth boundary.

Bt2—17 to 23 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; strong medium subangular blocky structure; hard, firm; few fine roots; common distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt3—23 to 27 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; few very fine roots; common faint clay films on faces of peds; slight effervescence; mildly alkaline; clear smooth boundary.

Bk—27 to 47 inches; very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; weak fine granular structure; slightly hard, friable; many soft accumulations of lime; violent effervescence; moderately alkaline; clear smooth boundary.

C—47 to 60 inches; very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; few threads of lime; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 47 inches. The depth to free carbonates ranges from 18 to 30 inches. The mollic epipedon is 10 to 20 inches thick. It includes the upper part of the argillic horizon in some pedons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is typically silt loam, but in some pedons it is silty clay loam. The Bt horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is silty clay loam or silty clay. It is typically neutral or mildly alkaline but ranges from slightly acid to moderately alkaline. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Heizer Series

The Heizer series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in chalky limestone residuum. Slopes range from 5 to 30 percent.

Heizer soils are commonly adjacent to Armo, Bogue, Brownell, and Mento soils. The deep Armo soils are on foot slopes and side slopes above or below the Heizer soils. The moderately deep Bogue soils are on side slopes below the Heizer soils. The moderately deep Brownell soils are on side slopes above the Heizer soils. The deep Mento soils are in gently sloping areas above the Heizer soils.

Typical pedon of Heizer gravelly loam, in an area of Heizer-Brownell gravelly loams, 5 to 30 percent slopes; 1,700 feet west and 600 feet south of the northeast corner of sec. 10, T. 15 S., R. 21 W.

A—0 to 6 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; about 20 percent fine and medium limestone fragments; violent effervescence; moderately alkaline; clear smooth boundary.

AC—6 to 9 inches; dark grayish brown (10YR 4/2) very channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; about 40 percent limestone channers; violent effervescence; moderately alkaline; clear smooth boundary.

C—9 to 15 inches; light brownish gray (10YR 6/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; about 40 percent limestone channers; violent effervescence; moderately alkaline; abrupt smooth boundary.

R—15 inches; white, hard limestone.

The depth to limestone ranges from 10 to 20 inches. The mollic epipedon is 7 to 12 inches thick. The soils contain free carbonates throughout and are mildly alkaline or moderately alkaline.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3. The content of limestone channers 0.5 inch to 6.0 inches in size along the longer axis ranges from 35 to 60 percent in this horizon.

Holdrege Series

The Holdrege series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 1 to 3 percent.

Holdrege soils are similar to Coly and Uly soils and are commonly adjacent to Coly, Harney, and Uly soils. Coly and Uly soils are on side slopes below the Holdrege soils. They have less clay in the subsoil than the Holdrege soils. Also, Coly soils do not have a mollic epipedon. Harney soils have more clay in the subsoil than the Holdrege soils. Also, they are higher on the landscape.

Typical pedon of Holdrege silt loam, 1 to 3 percent slopes, 1,500 feet west and 100 feet north of the southeast corner of sec. 4, T. 13 S., R. 23 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

A—5 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

Bt1—9 to 14 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; few faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bt2—14 to 22 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; few faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

BC—22 to 27 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard,

friable; few fine roots; mildly alkaline; clear smooth boundary.

C1—27 to 50 inches; very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; few threads and concretions of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C2—50 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, friable; many threads of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 38 inches. The mollic epipedon is 10 to 20 inches thick. The depth to free carbonates ranges from 20 to 32 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). It is typically silt loam, but in some pedons it is silty clay loam. It ranges from neutral to medium acid. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is neutral or mildly alkaline. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Hord Series

The Hord series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in a mixture of loess and alluvium. Slopes range from 0 to 2 percent.

Hord soils are similar to McCook and Roxbury soils and are commonly adjacent to those soils. McCook and Roxbury soils are shallower to calcareous material than the Hord soils. They are on flood plains along the larger streams.

Typical pedon of Hord silt loam, 2,450 feet south and 50 feet east of the northwest corner of sec. 28, T. 12 S., R. 23 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many very fine roots; many fine tubular pores; neutral; clear smooth boundary.

A1—6 to 14 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; many fine tubular pores; neutral; clear smooth boundary.

A2—14 to 19 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; many fine tubular pores; neutral; clear smooth boundary.

Bw—19 to 27 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; many fine tubular pores; neutral; clear smooth boundary.

BC—27 to 37 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; moderate medium granular structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

C—37 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, friable; few masses and common threads of lime; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 60 inches. The mollic epipedon ranges from 20 to 40 inches in thickness and extends into the Bw horizon. The depth to carbonates ranges from 20 to 48 inches. Typically, the C horizon has free carbonates.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It typically is silt loam, but in some pedons it is fine sandy loam or silty clay loam. It ranges from medium acid to neutral. The Bw horizon has a range in color similar to that of the A horizon. It typically is slightly acid or neutral but ranges from slightly acid to mildly alkaline. It is silt loam or silty clay loam. The content of clay in the B and BC horizons ranges from 20 to 35 percent. The BC and C horizons are mildly alkaline or moderately alkaline. The BC horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. The C horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 or 3. It is silt loam, very fine sandy loam, or silty clay loam.

Humbarger Series

The Humbarger series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in calcareous, loamy alluvium. Slopes range from 0 to 2 percent.

Humbarger soils are commonly adjacent to Armo, Penden, and Wakeen soils on uplands. The adjacent soils have a mollic epipedon that is less than 20 inches thick. Also, Wakeen soils are moderately deep over bedrock.

Typical pedon of Humbarger loam, occasionally flooded, 2,310 feet north and 310 feet east of the southwest corner of sec. 5, T. 14 S., R. 25 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

A—6 to 20 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

AC—20 to 32 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common fine

roots; violent effervescence; moderately alkaline; clear smooth boundary.

C—32 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 20 to 32 inches. Most pedons are calcareous at the surface, but some do not have visible lime in the upper 10 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam, but in some pedons it is clay loam or silt loam. It is mildly alkaline or moderately alkaline. The AC horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is typically loam or clay loam, but the range includes silty clay loam and sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is loam, sandy loam, or clay loam.

Inavale Series

The Inavale series consists of deep, excessively drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Inavale soils are commonly adjacent to Munjor soils. The adjacent soils are less sandy than the Inavale soils. They are are in landscape positions similar to those of the Inavale soils or are lower on the landscape.

Typical pedon of Inavale loamy sand, channeled, 1,200 feet north and 300 feet east of the southwest corner of sec. 35, T. 14 S., R. 24 W.

A—0 to 6 inches; light gray (10YR 7/2) loamy sand, brown (10YR 5/3) moist; single grained; soft, very friable; common fine roots; few fine pebbles; mildly alkaline; clear smooth boundary.

C—6 to 60 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; single grained; soft, very friable; few fine pebbles; few thin strata of finer or coarser textured material; strong effervescence; moderately alkaline.

Reaction ranges from slightly acid to moderately alkaline throughout the profile. The A horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3.

Manvel Series

The Manvel series consists of deep, well drained, moderately permeable soils on foot slopes in the uplands. These soils formed in a thick layer of very calcareous colluvium derived from chalk. Slopes range from 5 to 15 percent.

Manvel soils are commonly adjacent to the shallow Nibson soils on the higher side slopes.

Typical pedon of Manvel silt loam, in an area of Badland-Manvel complex, 3 to 20 percent slopes; 1,250 feet west and 1,000 feet south of the northeast corner of sec. 13, T. 14 S., R. 25 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

AC—3 to 10 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; weak fine granular structure; slightly hard, friable; common fine roots; few chalk fragments; violent effervescence; moderately alkaline; clear smooth boundary.

C—10 to 60 inches; very pale brown (10YR 8/3) silt loam, very pale brown (10YR 7/3) moist; massive; soft, very friable; few masses of lime; few shale fragments; violent effervescence; moderately alkaline.

Typically, free carbonates are at the surface. Some pedons have discontinuous accumulations of carbonate. The content of chalk fragments is less than 2 percent throughout the profile. The A horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 to 4. The AC and C horizons have value of 6 to 8 (3 to 7 moist) and chroma of 2 to 4.

McCook Series

The McCook series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in calcareous, silty alluvium. Slopes range from 0 to 2 percent.

McCook soils are similar to Hord soils and are commonly adjacent to Hord, Inavale, Munjor, and Roxbury soils. The adjacent soils are in landscape positions similar to those of the McCook soils. Hord and Roxbury soils have a mollic epipedon that is more than 20 inches thick. Also, Hord soils have carbonates below a depth of 20 inches. Inavale and Munjor soils contain more sand than the McCook soils and do not have a mollic epipedon.

Typical pedon of McCook silt loam, occasionally flooded, 2,490 feet east and 350 feet north of the southwest corner of sec. 4, T. 11 S., R. 25 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; common fine roots; mildly alkaline; clear smooth boundary.

A—7 to 16 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common fine

roots; slight effervescence; moderately alkaline; clear smooth boundary.

AC—16 to 26 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, friable; few fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C—26 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; hard, friable; stratified with thin bands of fine sandy loam; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 33 inches. The mollic epipedon ranges from 10 to 20 inches in thickness. The depth to carbonates ranges from 0 to 10 inches. The part of the profile below the mollic epipedon is stratified with thin layers that vary in color and in content of clay and sand. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but the range includes loam and fine sandy loam. The AC and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. They are silt loam or very fine sandy loam.

Mento Series

The Mento series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in loess over chalky limestone residuum. Slopes range from 1 to 3 percent.

Mento soils are similar to Carlson and Harney soils and are commonly adjacent to Brownell, Harney, and Heizer soils. The moderately deep Brownell soils and the shallow Heizer soils are on side slopes below the Mento soils. Carlson and Harney soils are higher on the landscape than the Mento soils. Carlson soils have old alluvial sediments within a depth of 40 inches. Harney soils do not have an abrupt boundary between the A and Bt horizons.

Typical pedon of Mento silt loam, in an area of Harney-Mento silt loams, 1 to 3 percent slopes; 1,100 feet east and 300 feet south of the northwest corner of sec. 30, T. 15 S., R. 21 W.

A—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—8 to 13 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; common distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bt2—13 to 22 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm; common fine roots; few faint clay films on faces of peds; few masses of lime; strong effervescence; mildly alkaline; clear smooth boundary.

Bk—22 to 33 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, firm; few fine roots; common threads of lime; violent effervescence; moderately alkaline; clear smooth boundary.

C—33 to 46 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; few threads of lime; violent effervescence; moderately alkaline; clear smooth boundary.

2C1—46 to 55 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; moderately alkaline; violent effervescence; clear smooth boundary.

2C2—55 to 60 inches; very pale brown (10YR 8/3) clay loam, very pale brown (10YR 7/4) moist; massive; slightly hard, friable; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 10 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is typically silt loam, but in some pedons it is silty clay loam. It is neutral or mildly alkaline. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is silty clay loam or silty clay. It is mildly alkaline or moderately alkaline. The Bk and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. They are silt loam or silty clay loam. The 2C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 to 4. It is clay loam or gravelly clay loam.

Munjor Series

The Munjor series consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in calcareous, loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Munjor soils are commonly adjacent to Dorrance, Inavale, McCook, and Roxbury soils. Dorrance and Inavale soils have more sand than the Munjor soils. Dorrance soils are on side slopes in the uplands. Inavale soils are lower on the landscape than the Munjor soils. McCook and Roxbury soils have a mollic epipedon. They are on flood plains above the Munjor soils.

Typical pedon of Munjor sandy loam, occasionally flooded, 2,200 feet south and 200 feet west of the northeast corner of sec. 3, T. 11 S., R. 21 W.

A—0 to 8 inches; pale brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common fine

roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—8 to 19 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—19 to 32 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; few fine roots; few strata of finer or coarser textured material; strong effervescence; moderately alkaline; gradual smooth boundary.

2C—32 to 60 inches; light gray (10YR 7/2) loamy sand, brown (10YR 5/3) moist; single grained; loose; strong effervescence; moderately alkaline.

The soils are mildly alkaline or moderately alkaline throughout. The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 to 3. It is typically sandy loam, but in some pedons it is loam or fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. The 2C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4. It is loamy sand or sand. Some pedons contain gravel.

Nibson Series

The Nibson series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from chalky limestone. Slopes range from 3 to 8 percent.

The Nibson soils in this county do not have a mollic epipedon, which is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Nibson soils are commonly adjacent to Armo and Wakeen soils. The deep Armo soils are on foot slopes and side slopes below the Nibson soils. The moderately deep Wakeen soils are on side slopes above the Nibson soils.

Typical pedon of Nibson silt loam, in an area of Wakeen-Nibson silt loams, 3 to 8 percent slopes; 2,490 feet north and 75 feet west of the southeast corner of sec. 33, T. 8 S., R. 21 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; few fine pores; strong effervescence; moderately alkaline; clear smooth boundary.

Bw—6 to 11 inches; very pale brown (10YR 7/3) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; about 2 percent fine chalk fragments; strong effervescence; moderately alkaline; clear smooth boundary.

C—11 to 14 inches; white (10YR 8/2) silty clay loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; few fine roots; about 2 percent fragments of lime; violent effervescence; strongly alkaline; clear smooth boundary.

Cr—14 inches; chalky limestone.

The depth to unweathered chalk ranges from 10 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 3 to 6 (2 to 5 moist), and chroma of 1 or 2. It ranges from mildly alkaline to strongly alkaline. The Bw and C horizons are silt loam or silty clay loam. They are moderately alkaline or strongly alkaline. The Bw horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4.

Penden Series

The Penden series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy sediments. Slopes range from 3 to 15 percent.

Penden soils are similar to Campus soils and are commonly adjacent to Campus, Coly, Humbarger, and Uly soils. The moderately deep Campus soils are lower on the landscape than the Penden soils. Coly soils do not have a mollic epipedon. They are on side slopes above the Penden soils. Humbarger soils have a mollic epipedon that is more than 20 inches thick. They are on flood plains. The silty Uly soils are on side slopes above the Penden soils.

Typical pedon of Penden loam, 7 to 15 percent slopes, 2,275 feet south and 780 feet east of the northwest corner of sec. 25, T. 11 S., R. 21 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

A2—8 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

Bk—14 to 32 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; few concretions and many masses of lime; few medium quartz grains; violent effervescence; moderately alkaline; gradual smooth boundary.

C—32 to 60 inches; very pale brown (10YR 8/3) loam, very pale brown (10YR 7/4) moist; massive; hard, friable; few fine roots; common masses and few

concretions of lime; violent effervescence; moderately alkaline.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but in some pedons it is clay loam or silty clay loam. It is mildly alkaline or moderately alkaline. The Bk and C horizons are clay loam or loam. The Bk horizon has hue of 7.5YR or 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 or 3. The C horizon has hue of 7.5YR or 10YR, value of 5 to 8 (4 to 7 moist), and chroma of 2 to 4.

Because of erosion, Penden clay loam, 3 to 7 percent slopes, eroded, does not have a mollic epipedon. This difference, however, does not alter the usefulness or behavior of the soil.

Roxbury Series

The Roxbury series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in calcareous, silty alluvium. Slopes range from 0 to 2 percent.

Roxbury soils are similar to Hord and McCook soils and are commonly adjacent to Hord, McCook, and Munjor soils. Hord soils have carbonates below a depth of 20 inches. They are higher on the flood plains than the Roxbury soils. McCook soils have a mollic epipedon that is less than 20 inches thick. They are in positions on the flood plains similar to those of the Roxbury soils. The loamy Munjor soils do not have a mollic epipedon. They are lower on the flood plains than the Roxbury soils.

Typical pedon of Roxbury silt loam, 1,700 feet north and 225 feet west of the southeast corner of sec. 17, T. 13 S., R. 21 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

A1—5 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

A2—12 to 24 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; common very fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

AC—24 to 29 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; few fine roots; few fine threads of lime; violent effervescence; moderately alkaline; clear smooth boundary.

C1—29 to 49 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable; few fine strata of darker material; few fine threads of lime; violent effervescence; moderately alkaline; clear smooth boundary.

C2—49 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; many fine threads of lime; violent effervescence; moderately alkaline.

The solum and the mollic epipedon range from 20 to 40 inches in thickness. The depth to lime ranges from 0 to 15 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but in some pedons it is loam or silty clay loam. The AC and C horizons have value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. They are dominantly silt loam or silty clay loam. In some pedons, however, strata of sandy or clayey material are below a depth of 40 inches.

Uly Series

The Uly series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 1 to 6 percent.

Uly soils are similar to Coly and Holdrege soils and are commonly adjacent to Coly, Harney, Holdrege, and Penden soils. Coly soils do not have a mollic epipedon. They are in positions on the landscape similar to those of the Uly soils. Harney and Holdrege soils have an argillic horizon. They are on ridgetops and gently sloping side slopes above the Uly soils. Penden soils have carbonates at the surface and have more sand in the subsoil than the Uly soils. They are in landscape positions similar to those of the Uly soils or are lower on the landscape.

Typical pedon of Uly silt loam, 1 to 3 percent slopes, 2,100 feet east and 1,000 feet south of the northwest corner of sec. 3, T. 15 S., R. 25 W.

A—0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; many fine tubular pores; mildly alkaline; clear smooth boundary.

Bw—10 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; many fine roots; many tubular pores; slight effervescence; mildly alkaline; clear smooth boundary.

BC—15 to 20 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine tubular pores; few threads of

lime; strong effervescence; moderately alkaline; clear smooth boundary.

C—20 to 60 inches; very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable; few threads of lime; violent effervescence; moderately alkaline.

The solum ranges from 12 to 36 inches in thickness. The mollic epipedon is 7 to 16 inches thick. The depth to free carbonates ranges from 8 to 20 inches.

The A horizon has value of 3 to 5 (2 or 3 moist). It typically is silt loam, but in some pedons it is very fine sandy loam. It ranges from slightly acid to mildly alkaline. The B horizon has value of 4 to 7 (2 to 5 moist) and chroma of 2 or 3. It typically is silt loam, but in some pedons it is silty clay loam. It typically is mildly alkaline or moderately alkaline but ranges from slightly acid to moderately alkaline. In some pedons the lower part of this horizon has an accumulation of carbonates. The C horizon has hue of 10YR or 7.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4.

Voda Series

The Voda series consists of deep, somewhat poorly drained soils on the flood plain adjacent to Cedar Bluff Reservoir. The flood plain formerly was inundated by water from the reservoir. These soils formed in clayey alluvium over silty alluvium. Permeability is slow in the upper part of the substratum and moderate in the lower part. Slopes range from 0 to 2 percent.

Voda soils are commonly adjacent to Munjor soils on stream terraces. The adjacent soils are more sandy throughout than the Voda soils.

Typical pedon of Voda silty clay loam, occasionally flooded, 1,500 feet south and 500 feet east of the northwest corner of sec. 1, T. 15 S., R. 23 W.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—7 to 24 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; common medium prominent dark brown (10YR 4/4) mottles; moderate medium platy structure; few thin strata of lighter or darker material; hard, firm; violent effervescence; moderately alkaline; clear smooth boundary.

2C2—24 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 4/2) moist; many fine prominent yellowish brown (10YR 5/4) mottles; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The depth to lime ranges from 0 to 10 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. If the dry value is 5 or less, this horizon is less than 10 inches thick. It is typically silty clay loam, but in some pedons it is silty clay. The C horizon has value of 10YR, 2.5Y, or 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. It is dominantly silty clay, but in some pedons it is stratified with loamy sand. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It is dominantly fine sandy loam, loamy fine sand, silt loam, or very fine sandy loam. In some pedons, however, it has thin strata of sand.

Wakeen Series

The Wakeen series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from chalky limestone. Slopes range from 1 to 8 percent.

Wakeen soils are commonly adjacent to Armo, Campus, Canlon, Humbarger, and Nibson soils. The deep Armo soils are on foot slopes and side slopes below the Wakeen soils. Campus and Canlon soils contain more sand in the subsoil than the Wakeen soils. Also, they are are higher on the landscape. Humbarger soils have a mollic epipedon that is more than 20 inches thick. They are on flood plains. The shallow Nibson soils are on side slopes below the Wakeen soils.

Typical pedon of Wakeen silt loam, in an area of Wakeen-Nibson silt loams, 3 to 8 percent slopes; about 1,525 feet east and 300 feet south of the northwest corner of sec. 23, T. 13 S., R. 21 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

A2—4 to 11 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

Bw1—11 to 17 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; about 14 percent fine chalk fragments; strong effervescence; moderately alkaline; clear smooth boundary.

Bw2—17 to 22 inches; pale yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; weak fine subangular blocky structure; slightly hard, friable; many fine roots; about 14 percent fine chalk fragments; violent effervescence; moderately alkaline; clear smooth boundary.

C—22 to 33 inches; white (2.5YR 8/2) silt loam, light yellowish brown (2.5YR 6/4) moist; massive; soft,

friable; common fine roots; about 14 percent fine chalk fragments; violent effervescence; moderately alkaline; clear smooth boundary.

Cr—33 inches; very pale yellow chalky limestone.

The thickness of solum and the depth to bedrock range from 20 to 40 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. The soils contain lime throughout.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline. The Bw horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 5. It typically is silty clay loam, but in some pedons it is silt loam. It typically is moderately alkaline or strongly alkaline but ranges from mildly alkaline to strongly alkaline.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of a soil at any given point are determined by the interaction of five factors of soil formation: climate, plants and other living organisms, parent material, relief, and time. Each of these factors influences the formation of every soil, and each modifies the effects of the other four. The relative effects of the individual factors vary from place to place. The interactions among these factors are more complex for some soils than for others.

Parent Material

Parent material is the unconsolidated material in which soils form. It either is material weathered from rocks through freezing and thawing, abrasion, erosion, or chemical processes or is material deposited by wind or water. The parent material affects texture, structure, color, natural fertility, and many other soil properties. Soils differ partly because of the various kinds of parent material. The texture of the parent material influences the rate of the downward movement of water and air and thus greatly affects soil formation. The composition of the parent material largely determines the mineralogical composition of the soil and, hence, its natural fertility. The soils in Trego County formed in recent alluvium, old alluvium, colluvium, loess, and chalky limestone and shale residuum.

Alluvium is water-deposited material. Both recent and old alluvial sediments are evident in Trego County. The recent alluvium is in stream valleys. Humbarger, Inavale, McCook, Munjor, Roxbury, and Voda soils formed in this material. Old alluvial sediments are on what are now uplands. Dorrance and Penden soils formed in these sediments. Hord soils formed in a mixture of loess and alluvium.

Colluvium is loamy or silty material that accumulated at the base of the steeper slopes as a result of gravity. It is derived from chalky shale and limestone bedrock. Armo and Manvel soils formed in colluvial material.

Loess is silty, wind-deposited material, some of which was carried hundreds of miles from its source. Peorian Loess of the Wisconsin Glaciation, which covers many of the uplands in Trego County, was deposited during the Pleistocene. In most areas it is very pale brown or light gray and is calcareous and friable. Coly, Harney, Holdrege, and Uly soils formed in this material. Carlson soils formed partly in this material.

The bedrock that crops out in Trego County consists of chalky limestone or shale and noncalcareous, blue gray shale of the Upper Cretaceous System. The calcareous Brownell, Heizer, Nibson, and Wakeen soils formed in material weathered from the chalky limestone or shale. Bogue soils formed in material weathered from the noncalcareous, blue gray shale.

Climate

Climate is an active factor of soil formation. It directly influences soil formation by weathering the parent material. It indirectly affects soil formation through its effect on plants and animals. Soil-forming processes are most active when the soil is warm and moist.

The climate in Trego County is typical continental. It is characterized by intermittent dry and moist periods, which can last for less than a year or for several years. The soil material dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become so saturated that excess moisture penetrates the substratum. Because of the wetting and drying, some of the basic nutrients, and even clay particles, have been leached from the upper horizons. An accumulation of lime in the lower part of the subsoil in Holdrege soils is an indication of leaching by excess moisture. The downward movement of water is a major factor in the transformation of the parent material into a soil that has distinct horizons.

Plant and Animal Life

Plants and animals have important effects on soil formation. Plants generally influence the content of nutrients and organic matter in the soil and the color of the surface layer. Earthworms, cicadas, and other burrowing animals help to keep the soil open and porous. Bacteria and fungi help to decompose the plants, thus releasing plant nutrients.

Mid and tall prairie grasses have had the greatest influence on soil formation in Trego County. As a result of these grasses, the upper part of a typical soil in the county is dark and is high in content of organic matter. In many areas the next layer is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color.

Human activities have greatly affected soil formation. In most areas they have increased the susceptibility to erosion, increased or decreased the organic matter content, or changed the relief by land leveling and by industrial and urban development.

Relief

Relief, or lay of the land, influences the formation of soils through its effect on drainage, runoff, plant cover, and soil temperature. It is important mainly because it controls the movement of water on the surface and into the soil.

Runoff is more rapid on the steeper upland soils than on the less sloping soils. As a result, erosion is more extensive. Nibson soils formed in old parent material, but relief has restricted their formation. Runoff is medium on these moderately sloping soils, and much of the soil material is removed as soon as soil formation occurs.

Time

The length of time needed for soil formation depends largely on the other factors of soil formation. As water moves downward through the soil, soluble material and fine particles are gradually leached from the surface layer to the subsoil. The extent of leaching depends on the amount of time that has elapsed and the amount of water that has penetrated the surface.

Differences in the length of time that the parent material has been exposed to the processes of soil formation are reflected in the degree of profile development. For example, the young McCook soils, which formed in recent alluvium, show very little evidence of horizon development other than a slight darkening of the surface layer. In contrast, the older Holdrege soils, which have been exposed to soil-forming processes for thousands of years, have well defined horizons.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of

soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil

before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-76 at WaKeeney, Kansas)

Month	Temperature					Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	In	In	In		In
January----	40.8	16.0	28.4	72	-10	0.45	0.10	0.76	1	5.0
February---	46.2	20.8	33.5	82	-1	.74	.18	1.22	2	6.4
March------	52.3	26.6	39.5	86	2	1.61	.31	2.23	3	9.0
April------	65.1	39.1	52.1	91	19	1.80	.87	2.65	4	2.7
May--------	74.6	50.0	62.3	98	29	3.72	1.96	6.02	6	.0
June-------	84.7	59.9	72.3	105	43	3.64	1.77	5.44	6	.0
July-------	90.4	65.4	77.9	106	51	3.03	2.00	4.07	5	.0
August-----	89.3	63.7	76.5	105	51	2.95	1.30	4.55	4	.0
September--	79.2	53.4	66.3	101	35	2.47	.89	4.25	4	.0
October----	69.5	42.0	55.8	94	23	1.36	.11	2.00	3	.5
November---	53.4	28.2	40.8	77	1	1.03	.09	2.13	2	4.9
December---	43.5	19.8	31.7	72	-4	.58	.10	1.17	2	5.8
Year-----	65.8	40.4	53.1	107	-12	23.38	16.63	29.25	42	34.3

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 17	Apr. 27	May 14
2 years in 10 later than--	Apr. 12	Apr. 22	May 9
5 years in 10 later than--	Apr. 3	Apr. 12	Apr. 29
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 21	Oct. 15	Oct. 1
2 years in 10 earlier than--	Oct. 25	Oct. 20	Oct. 5
5 years in 10 earlier than--	Nov. 4	Oct. 29	Oct. 15

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	198	182	145
8 years in 10	204	188	153
5 years in 10	215	200	169
2 years in 10	226	212	185
1 year in 10	232	218	193

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ap	Armo loam, 1 to 3 percent slopes	16,000	2.8
Ar	Armo loam, 3 to 7 percent slopes	35,500	6.2
As	Armo loam, 7 to 15 percent slopes	31,050	5.4
Bd	Badland-Manvel complex, 3 to 20 percent slopes	5,700	1.0
Bg	Bogue clay, 8 to 25 percent slopes	3,300	0.6
Br	Brownell gravelly loam, 2 to 10 percent slopes	6,350	1.1
Cc	Campus-Canlon loams, 6 to 30 percent slopes	8,800	1.5
Cf	Carlson silt loam, 1 to 3 percent slopes	42,550	7.4
Cu	Coly silt loam, 2 to 6 percent slopes	11,150	1.9
Do	Dorrance sandy loam, 3 to 15 percent slopes	10,200	1.8
Ha	Harney silt loam, 0 to 1 percent slopes	84,450	14.6
He	Harney-Mento silt loams, 1 to 3 percent slopes	15,385	2.7
Hg	Heizer-Brownell gravelly loams, 5 to 30 percent slopes	21,600	3.7
Hm	Holdrege silt loam, 1 to 3 percent slopes	89,800	15.5
Ho	Hord silt loam	7,350	1.3
Hu	Humbarger loam, channeled	22,100	3.8
Hw	Humbarger loam, occasionally flooded	7,550	1.3
If	Inavale loamy sand, channeled	5,750	1.0
Mc	McCook silt loam, occasionally flooded	2,850	0.5
Mu	Munjor sandy loam, occasionally flooded	8,000	1.4
Pf	Penden clay loam, 3 to 7 percent slopes	41,150	7.1
Pk	Penden clay loam, 3 to 7 percent slopes, eroded	15,250	2.6
Po	Penden loam, 7 to 15 percent slopes	42,450	7.4
Rf	Roxbury silt loam	2,350	0.4
Ub	Uly silt loam, 1 to 3 percent slopes	11,300	2.0
Uc	Uly silt loam, 3 to 6 percent slopes	15,550	2.7
Vo	Voda silty clay loam, occasionally flooded	3,700	0.6
Wb	Wakeen silt loam, 1 to 3 percent slopes	2,031	0.4
Wp	Wakeen-Nibson silt loams, 3 to 8 percent slopes	5,500	1.0
	Water	1,700	0.3
	Total	576,416	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
Ap	Armo loam, 1 to 3 percent slopes
Ar	Armo loam, 3 to 7 percent slopes
Cf	Carlson silt loam, 1 to 3 percent slopes
Cu	Coly silt loam, 2 to 6 percent slopes
Ha	Harney silt loam, 0 to 1 percent slopes
He	Harney-Mento silt loams, 1 to 3 percent slopes
Hm	Holdrege silt loam, 1 to 3 percent slopes
Ho	Hord silt loam
Hw	Humbarger loam, occasionally flooded
Mc	McCook silt loam, occasionally flooded
Mu	Munjor sandy loam, occasionally flooded
Pf	Penden clay loam, 3 to 7 percent slopes
Rf	Roxbury silt loam
Ub	Uly silt loam, 1 to 3 percent slopes
Uc	Uly silt loam, 3 to 6 percent slopes
Wb	Wakeen silt loam, 1 to 3 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Winter wheat	Grain sorghum	Alfalfa hay
		Bu	Bu	Tons
Ap----------------------- Armo	IIe	32	43	---
Ar----------------------- Armo	IIIe	28	38	---
As----------------------- Armo	VIe	---	---	---
Bd----------------------- Badland-Manvel	VIIs	---	---	---
Bg----------------------- Bogue	VIe	---	---	---
Br----------------------- Brownell	VIe	---	---	---
Cc----------------------- Campus-Canlon	VIe	---	---	---
Cf----------------------- Carlson	IIe	33	47	---
Cu----------------------- Coly	IIIe	28	38	---
Do----------------------- Dorrance	VIs	---	---	---
Ha----------------------- Harney	IIc	35	49	---
He----------------------- Harney-Mento	IIe	30	42	---
Hg----------------------- Heizer-Brownell	VIIs	---	---	---
Hm----------------------- Holdrege	IIe	33	47	2.3
Ho----------------------- Hord	IIc	38	54	2.5
Hu----------------------- Humbarger	Vw	---	---	---
Hw----------------------- Humbarger	IIw	36	49	3.0
If----------------------- Inavale	VIw	---	---	---
Mc----------------------- McCook	IIw	34	46	2.8
Mu----------------------- Munjor	IIIw	30	43	2.0

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Winter wheat	Grain sorghum	Alfalfa hay
		Bu	Bu	Tons
Pf: Penden	IIIe	28	38	---
Pk: Penden	IVe	25	34	---
Po: Penden	VIe	---	---	---
Rf: Roxbury	IIc	36	49	3.0
Ub: Uly	IIe	32	45	2.4
Uc: Uly	IIIe	30	42	1.9
Vo: Voda	IIw	38	49	---
Wb: Wakeen	IIIe	28	38	---
Wp: Wakeen-Nibson	IVe	22	31	---

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo-sition
		Kind of year	Dry weight		
			Lb/acre		Pct
Ap, Ar, As: Armo	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Leadplant	5
				Western wheatgrass	5
Bd*:					
Badland.					
Manvel	Chalk Flats	Favorable	2,000	Little bluestem	25
		Normal	1,500	Sideoats grama	15
		Unfavorable	1,000	Blue grama	15
				Buffalograss	10
				Big bluestem	5
				Western wheatgrass	5
Bg: Bogue	Blue Shale	Favorable	3,000	Big bluestem	40
		Normal	2,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Leadplant	10
				Indiangrass	5
Br: Brownell	Limy Upland	Favorable	3,000	Little bluestem	30
		Normal	2,000	Big bluestem	20
		Unfavorable	1,000	Sideoats grama	20
				Switchgrass	5
				Blue grama	5
				Western wheatgrass	5
Cc*:					
Campus	Limy Upland	Favorable	3,000	Little bluestem	30
		Normal	2,000	Big bluestem	20
		Unfavorable	1,000	Sideoats grama	20
				Switchgrass	5
				Blue grama	5
				Western wheatgrass	5
Canlon	Shallow Limy	Favorable	2,400	Little bluestem	25
		Normal	1,600	Sideoats grama	20
		Unfavorable	900	Big bluestem	10
				Switchgrass	5
				Hairy grama	5
				Plains muhly	5
				Blue grama	5
Cf: Carlson	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,500	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
				Western ragweed	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
Cu: Coly	Limy Upland	Favorable	3,300	Little bluestem	30
		Normal	3,000	Big bluestem	20
		Unfavorable	2,700	Sideoats grama	10
				Western wheatgrass	10
				Sedge	5
				Blue grama	5
				Indiangrass	5
Do: Dorrance	Sands	Favorable	3,000	Little bluestem	20
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,500	Blue grama	10
				Indiangrass	10
				Switchgrass	10
Ha: Harney	Loamy Upland	Favorable	4,000	Sideoats grama	20
		Normal	2,200	Blue grama	20
		Unfavorable	1,000	Big bluestem	10
				Buffalograss	10
				Western wheatgrass	10
				Little bluestem	5
				Western ragweed	5
He*:					
Harney	Loamy Upland	Favorable	4,000	Sideoats grama	20
		Normal	2,200	Blue grama	20
		Unfavorable	1,000	Big bluestem	10
				Buffalograss	10
				Western wheatgrass	10
				Little bluestem	5
				Western ragweed	5
Mento	Clay Upland	Favorable	3,500	Blue grama	35
		Normal	2,000	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	10
				Buffalograss	10
				Big bluestem	5
				Western ragweed	5
Hg*:					
Heizer	Shallow Limy	Favorable	3,000	Little bluestem	40
		Normal	2,000	Big bluestem	25
		Unfavorable	900	Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
Brownell	Limy Upland	Favorable	3,000	Little bluestem	30
		Normal	2,000	Big bluestem	20
		Unfavorable	1,000	Sideoats grama	20
				Switchgrass	5
				Blue grama	5
				Western wheatgrass	5
Hm: Holdrege	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	3,600	Little bluestem	20
		Unfavorable	3,300	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Indiangrass	5
				Buffalograss	5
				Sand dropseed	5
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Ho Hord	Loamy Terrace	Favorable	4,500	Big bluestem	30
		Normal	4,200	Little bluestem	20
		Unfavorable	3,800	Switchgrass	10
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
Hu, Hw Humbarger	Loamy Lowland	Favorable	5,000	Big bluestem	40
		Normal	4,000	Western wheatgrass	15
		Unfavorable	2,500	Sideoats grama	10
				Little bluestem	5
				Indiangrass	5
				Switchgrass	5
If Inavale	Sandy Lowland	Favorable	3,500	Sand bluestem	45
		Normal	3,000	Porcupinegrass	15
		Unfavorable	2,000	Little bluestem	10
				Prairie sandreed	10
				Switchgrass	5
				Needleandthread	5
				Sedge	5
Mc McCook	Loamy Lowland	Favorable	4,800	Big bluestem	35
		Normal	3,500	Switchgrass	15
		Unfavorable	2,800	Indiangrass	10
				Sideoats grama	10
				Little bluestem	5
				Western wheatgrass	5
Mu Munjor	Sandy Lowland	Favorable	5,000	Sand bluestem	35
		Normal	4,000	Switchgrass	15
		Unfavorable	3,000	Indiangrass	10
				Little bluestem	10
				Western wheatgrass	5
				Chickasaw plum	5
Pf, Pk, Po Penden	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
				Leadplant	5
Rf Roxbury	Loamy Terrace	Favorable	4,000	Big bluestem	35
		Normal	3,000	Sideoats grama	25
		Unfavorable	2,000	Western wheatgrass	15
				Little bluestem	10
Ub, Uc Uly	Loamy Upland	Favorable	3,700	Big bluestem	25
		Normal	3,200	Little bluestem	25
		Unfavorable	2,700	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Vo: Voda	Clay Lowland	Favorable	5,500	Switchgrass	20
		Normal	4,000	Big bluestem	15
		Unfavorable	3,000	Sideoats grama	15
				Western wheatgrass	10
				Indiangrass	5
Wb: Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Wp*:					
Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Nibson	Limy Upland	Favorable	4,000	Big bluestem	30
		Normal	2,500	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	20
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Ap, Ar, As: Armo	Fragrant sumac, Siberian peashrub, silver buffaloberry, Amur honeysuckle.	Eastern redcedar, bur oak, Russian-olive, Rocky Mountain juniper.	Ponderosa pine, honeylocust, green ash, Siberian elm.	---	---
Bd*: Badland.					
Manvel	Siberian peashrub, fragrant sumac, silver buffaloberry, Amur honeysuckle.	Eastern redcedar, Rocky Mountain juniper, black locust, Russian-olive.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---
Bg: Bogue	Peking cotoneaster, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, hackberry, Russian-olive, green ash, Rocky Mountain juniper.	Austrian pine, honeylocust, Russian mulberry.	Siberian elm	---
Br. Brownell					
Cc*: Campus	Siberian peashrub, fragrant sumac, silver buffaloberry, Amur honeysuckle.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, black locust.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---
Canlon.					
Cf: Carlson	Lilac, Amur honeysuckle, fragrant sumac.	Russian mulberry	Eastern redcedar, green ash, honeylocust, Russian-olive, bur oak, Austrian pine, hackberry.	Siberian elm	---
Cu: Coly	Silver buffaloberry, fragrant sumac, Siberian peashrub, Amur honeysuckle.	Eastern redcedar, Rocky Mountain juniper, bur oak, Russian-olive.	Green ash, ponderosa pine, honeylocust, Siberian elm.	---	---
Do. Dorrance					
Ha: Harney	Lilac, Amur honeysuckle, fragrant sumac.	Russian-olive, common chokecherry.	Eastern redcedar, ponderosa pine, honeylocust, green ash, bur oak, hackberry.	Siberian elm	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
He*:					
Harney	Lilac, Amur honeysuckle, fragrant sumac.	Russian-olive, common chokecherry.	Eastern redcedar, ponderosa pine, honeylocust, green ash, bur oak, hackberry.	Siberian elm	---
Mento	Lilac, Siberian peashrub, silver buffaloberry, tamarisk.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, green ash, Siberian elm.	Ponderosa pine	---	---
Hg*:					
Heizer.					
Brownell.					
Hm Holdrege	Lilac, Amur honeysuckle, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, hackberry, bur oak, Russian-olive.	Siberian elm	---
Ho Hord	Peking cotoneaster	Lilac, Siberian peashrub, American plum.	Eastern redcedar, ponderosa pine, blue spruce, Manchurian crabapple.	Golden willow, green ash, hackberry.	Eastern cottonwood.
Hu, Hw Humbarger	Fragrant sumac	Lilac, Amur honeysuckle, American plum.	Eastern redcedar, Russian mulberry.	Ponderosa pine, hackberry, bur oak, honeylocust, green ash.	Eastern cottonwood.
If. Inavale					
Mc McCook	American plum, lilac.	Amur honeysuckle	Eastern redcedar, ponderosa pine, Russian-olive, hackberry, green ash, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
Mu Munjor	American plum, fragrant sumac.	Amur honeysuckle, lilac.	Eastern redcedar, ponderosa pine, green ash, Russian mulberry, Russian-olive.	Honeylocust, hackberry.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Pf, Pk, Po: Penden	Fragrant sumac, silver buffaloberry, Siberian peashrub, Amur honeysuckle.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Siberian elm, honeylocust, ponderosa pine, green ash.	---	---
Rf: Roxbury	American plum, Amur honeysuckle.	Silver buffaloberry.	Eastern redcedar, hackberry, Russian-olive, Rocky Mountain juniper, ponderosa pine, green ash.	Siberian elm, honeylocust.	Eastern cottonwood.
Ub, Uc: Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, hackberry, bur oak.	Siberian elm	---
Vo: Voda	Fragrant sumac, American plum.	Russian-olive, silver buffaloberry.	Eastern redcedar, hackberry, ponderosa pine, Russian mulberry, honeylocust.	Green ash, Siberian elm.	Eastern cottonwood.
Wb: Wakeen	Siberian peashrub, fragrant sumac, silver buffaloberry, Amur honeysuckle.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---
Wp*:					
Wakeen	Siberian peashrub, fragrant sumac, silver buffaloberry, Amur honeysuckle.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---
Nibson.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ap, Ar: Armo	Slight	Slight	Moderate: slope.	Slight.
As: Armo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Bd*: Badland.				
Manvel	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.
Bg: Bogue	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
Br: Brownell	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight.
Cc*: Campus	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Canlon	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Moderate: slope.
Cf: Carlson	Slight	Slight	Moderate: slope.	Slight.
Cu: Coly	Slight	Slight	Moderate: slope.	Slight.
Do: Dorrance	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ha: Harney	Slight	Slight	Slight	Slight.
He*: Harney	Slight	Slight	Moderate: slope.	Slight.
Mento	Slight	Slight	Moderate: slope.	Slight.
Hg*: Heizer	Severe: slope, small stones, thin layer.	Severe: slope, small stones, thin layer.	Severe: slope, small stones, thin layer.	Moderate: slope.
Brownell	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hm: Holdrege	Slight	Slight	Moderate: slope.	Slight.
Ho: Hord	Severe: flooding.	Slight	Slight	Slight.
Hu: Humbarger	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Hw: Humbarger	Severe: flooding.	Slight	Moderate: flooding.	Slight.
If: Inavale	Severe: flooding.	Slight	Slight	Slight.
Mc: McCook	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Mu: Munjor	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Pf, Pk: Penden	Slight	Slight	Moderate: slope.	Slight.
Po: Penden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Rf: Roxbury	Severe: flooding.	Slight	Slight	Slight.
Ub, Uc: Uly	Slight	Slight	Moderate: slope.	Slight.
Vo: Voda	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Wb: Wakeen	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
Wp*:				
Wakeen	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
Nibson	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Ap----------------- Armo	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Ar----------------- Armo	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
As----------------- Armo	Poor	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
Bd*: Badland.									
Manvel------------	Poor	Fair	Fair	---	Very poor	Very poor	Poor	Very poor	Fair.
Bg----------------- Bogue	Poor	Fair	Poor	Poor	Very poor	Poor	Poor	Very poor	Poor.
Br----------------- Brownell	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
Cc*: Campus------------	Poor	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Fair.
Canlon------------	Very poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Cf----------------- Carlson	Good	Good	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
Cu----------------- Coly	Fair	Good	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
Do----------------- Dorrance	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Ha----------------- Harney	Good	Good	Good	Good	Poor	Fair	Good	Poor	Good.
He*: Harney------------	Good	Good	Good	Good	Poor	Fair	Good	Poor	Good.
Mento-------------	Fair	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Hg*: Heizer------------	Very poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Brownell----------	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
Hm----------------- Holdrege	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.
Ho----------------- Hord	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Hu----------------- Humbarger	Fair	Fair	Good	Fair	Poor	Poor	Fair	Poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
Hw----------------- Humbarger	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Fair.
If----------------- Inavale	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Mc----------------- McCook	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Mu----------------- Munjor	Fair	Fair	Good	Good	Poor	Poor	Fair	Poor	Good.
Pf, Pk------------- Penden	Fair	Good	Fair	Poor	Very poor	Poor	Fair	Very poor	Fair.
Po----------------- Penden	Poor	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor	Fair.
Rf----------------- Roxbury	Good	Good	Good	Fair	Poor	Fair	Good	Poor	Fair.
Ub----------------- Uly	Good	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Good.
Uc----------------- Uly	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Vo----------------- Voda	Fair	Fair	Fair	Fair	Good	Good	Fair	Good	---
Wb----------------- Wakeen	Fair	Good	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
Wp*:									
Wakeen------------	Fair	Good	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
Nibson------------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ap: Armo	Slight	Slight	Slight	Slight	Severe: low strength.
Ar: Armo	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
As: Armo	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Bd*: Badland.					
Manvel	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: low strength.
Bg: Bogue	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Br: Brownell	Severe: depth to rock.	Moderate: depth to rock, large stones.	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Moderate: depth to rock, large stones.
Cc*: Campus	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, low strength, slope.
Canlon	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Cf: Carlson	Slight	Slight	Slight	Slight	Severe: low strength.
Cu: Coly	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Do: Dorrance	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Ha: Harney	Moderate: too clayey.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
He*: Harney	Moderate: too clayey.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
Mento	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hg*:					
Heizer	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Brownell	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, large stones.
Hm Holdrege	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Ho Hord	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Hu, Hw Humbarger	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
If Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Mc McCook	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Mu Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Pf, Pk Penden	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Po Penden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Rf Roxbury	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Ub Uly	Slight	Slight	Slight	Slight	Severe: low strength.
Uc Uly	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Vo Voda	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.
Wb Wakeen	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wp*:					
Wakeen	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Nibson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ap, Ar: Armo	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: too clayey, thin layer.
As: Armo	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: too clayey, slope, thin layer.
Bd*: Badland.					
Manvel	Slight	Severe: slope.	Moderate: slope.	Moderate: slope.	Good.
Bg: Bogue	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
Br: Brownell	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage, large stones.	Moderate: seepage.	Poor: area reclaim, small stones, thin layer.
Cc*: Campus	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Canlon	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, slope, thin layer.
Cf: Carlson	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Cu: Coly	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Do: Dorrance	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ha: Harney	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
He*: Harney	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
He*:					
Mento	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones, thin layer.
Hg*:					
Heizer	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, small stones, slope.
Brownell	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, large stones.	Moderate: slope, seepage.	Poor: area reclaim, small stones, thin layer.
Hm Holdrege	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Ho Hord	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Hu, Hw Humbarger	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
If Inavale	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy, flooding.	Severe: seepage, flooding.	Poor: too sandy, seepage.
Mc McCook	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Mu Munjor	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: thin layer.
Pf, Pk Penden	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Po Penden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Rf Roxbury	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Ub, Uc Uly	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Vo Voda	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Wb------------------- Wakeen	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Wp*:					
Wakeen---------------	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Nibson---------------	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ap, Ar, As: Armo	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Bd*: Badland.				
Manvel	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bg: Bogue	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Br: Brownell	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Cc*: Campus	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Canlon	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
Cf: Carlson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Cu: Coly	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Do: Dorrance	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
Ha: Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
He*: Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Mento	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hg*: Heizer	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hg*:				
Brownell	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Hm Holdrege	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ho Hord	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hu, Hw Humbarger	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
If Inavale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Mc McCook	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Mu Munjor	Good	Probable	Improbable: too sandy.	Good.
Pf, Pk Penden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Po Penden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Rf Roxbury	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ub, Uc Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Vo Voda	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Wb Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Wp*:				
Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Nibson	Poor: area reclaim, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ap: Armo	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable	Favorable.
Ar: Armo	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope	Favorable	Favorable.
As: Armo	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope	Slope	Slope.
Bd*: Badland.						
Manvel	Moderate: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Bg: Bogue	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, percs slowly.	Slope, droughty, area reclaim.
Br: Brownell	Moderate: seepage, depth to rock, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Cc*: Campus	Severe: slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, depth to rock, area reclaim.	Slope, area reclaim.
Canlon	Severe: depth to rock, seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, depth to rock, area reclaim.	Slope, depth to rock, area reclaim.
Cf: Carlson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Cu: Coly	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Do: Dorrance	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Ha: Harney	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
He*: Harney	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
He*:						
Mento	Slight	Moderate: thin layer.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
Hg*:						
Heizer	Severe: depth to rock, seepage, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Brownell	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Hm Holdrege	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ho Hord	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Hu, Hw Humbarger	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
If Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Mc McCook	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Mu Munjor	Severe: seepage.	Severe: piping.	Deep to water	Flooding	Soil blowing	Favorable.
Pf, Pk Penden	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Po Penden	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Rf Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ub Uly	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Uc Uly	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Vo Voda	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness	Wetness, percs slowly.
Wb Wakeen	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Thin layer	Area reclaim, erodes easily.	Erodes easily, area reclaim.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Wp*:						
Wakeen	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
Nibson	Severe: seepage.	Severe: thin layer.	Deep to water	Slope, thin layer.	Area reclaim	Area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ap, Ar, As: Armo	0-16	Loam	CL	A-6, A-4	0	95-100	90-100	90-100	70-95	25-40	7-18
	16-38	Loam, silty clay loam, clay loam.	CL	A-6, A-4, A-7	0	95-100	90-100	90-100	70-90	25-45	7-22
	38-60	Silt loam, clay loam, loam.	CL	A-6, A-4, A-7	0	95-100	85-100	70-100	65-80	25-45	7-22
Bd*: Badland.											
Manvel	0-3	Silt loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	70-90	25-35	5-15
	3-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0	85-100	85-100	85-100	80-90	20-40	5-20
Bg: Bogue	0-6	Clay	CH, MH	A-7	0	100	100	90-100	90-100	55-80	25-45
	6-19	Clay	CH	A-7	0	100	100	90-100	90-100	55-80	30-50
	19-27	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-80	25-45
	27-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Br: Brownell	0-8	Gravelly loam	GC, SC, SM-SC, GM-GC	A-2-4, A-2-6, A-1	0-20	50-90	40-70	30-60	20-35	20-40	5-20
	8-28	Very gravelly loam, very channery loam, gravelly loam.	GC, GP-GC, SC, SP-SC	A-2-4, A-2-6, A-1	5-50	20-80	10-50	10-45	8-35	20-40	5-20
	28-32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cc*: Campus	0-7	Loam	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	55-90	20-40	3-20
	7-14	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	100	75-95	50-80	33-45	8-20
	14-36	Loam, clay loam	CL, ML, SC, SM	A-6, A-7, A-4	0	90-100	70-100	65-85	40-80	33-45	8-20
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Canlon	0-8	Loam	CL, CL-ML	A-4, A-6	0	90-100	75-100	65-100	50-90	20-40	4-20
	8-18	Loam, gravelly loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	75-100	55-100	50-95	35-85	20-40	4-20
	18-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cf: Carlson	0-4	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-40	5-20
	4-24	Silty clay loam, clay loam, silty clay.	CL, CH	A-7-6	0	100	100	90-100	85-100	40-55	20-30
	24-60	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7-6	0	100	95-100	80-100	55-100	25-45	5-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Cu-------------- Coly	0-4	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15
	4-60	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
Do-------------- Dorrance	0-11	Sandy loam-------	SC, CL, CL-ML, SM-SC	A-2, A-4	0	95-100	85-100	45-90	25-70	20-30	4-10
	11-16	Gravelly loamy sand, gravelly sandy loam, loamy sand.	SM, SM-SC, SP-SM	A-1, A-2	0-5	70-100	50-95	25-65	12-35	<25	NP-7
	16-60	Sand, gravelly sand, gravelly loamy sand.	SP-SM, SP	A-1, A-2, A-3	0	80-100	50-95	15-60	1-10	<20	NP
Ha-------------- Harney	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	7-27	Silty clay, silty clay loam.	CL, CH	A-7-6	0	100	100	95-100	85-100	40-60	15-35
	27-60	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	100	100	95-100	85-100	30-45	10-20
He*:											
Harney----------	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	11-27	Silty clay, silty clay loam.	CL, CH	A-7-6	0	100	100	95-100	85-100	40-60	15-35
	27-60	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	100	100	95-100	85-100	30-45	10-20
Mento-----------	0-8	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
	8-22	Silty clay loam, silty clay.	CH	A-7	0	100	95-100	90-100	85-100	50-70	25-45
	22-46	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	100	95-100	90-100	85-100	30-50	11-25
	46-60	Clay loam, silty clay loam, gravelly clay loam.	CL, SC, GC	A-6, A-7-6	0	70-100	65-95	55-95	40-80	35-50	15-30
Hg*:											
Heizer----------	0-6	Gravelly loam----	GC, SC, SM-SC, GM-GC	A-2-4, A-2-6, A-1	0-20	50-90	40-70	30-60	20-35	20-40	5-20
	6-15	Very channery loam, very gravelly loam.	GC, SC, GP-GC, SP-SC	A-2-4, A-2-6, A-1	5-50	20-80	10-50	10-45	8-35	20-40	5-20
	15-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Brownell--------	0-9	Gravelly loam----	GC, SC, SM-SC, GM-GC	A-2-4, A-2-6, A-1	0-20	50-90	40-70	30-60	20-35	20-40	5-20
	9-24	Very gravelly loam, very channery loam, gravelly loam.	GC, GP-GC, SC, SP-SC	A-2-4, A-2-6, A-1	5-50	20-80	10-50	10-45	8-35	20-40	5-20
	24-28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Hm Holdrege	0-9	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-40	2-18
	9-22	Silty clay loam	CL	A-7, A-6	0	100	100	98-100	90-100	30-50	15-35
	22-60	Silt loam	CL, ML	A-4, A-6	0	100	100	95-100	90-100	30-40	5-15
Ho Hord	0-14	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	14-37	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	37-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
Hu Humbarger	0-28	Loam, clay loam	CL, CL-ML	A-6, A-4	0	95-100	90-100	90-100	65-90	20-35	4-15
	28-49	Clay loam, loam, silty clay loam.	CL	A-6, A-4	0	95-100	90-100	80-95	55-85	25-40	8-20
	49-60	Clay loam, sandy loam, loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	90-100	80-95	40-80	20-40	5-20
Hw Humbarger	0-20	Loam	CL, CL-ML	A-6, A-4	0	95-100	90-100	90-100	65-90	20-35	4-15
	20-32	Clay loam, loam, silty clay loam.	CL	A-6, A-4	0	95-100	90-100	80-95	55-85	25-40	8-20
	32-60	Clay loam, sandy loam, loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	90-100	80-95	40-80	20-40	5-20
If Inavale	0-6	Loamy sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	95-100	85-95	5-35	<25	NP-5
	6-60	Sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	95-100	70-90	5-30	<25	NP-5
Mc McCook	0-16	Silt loam	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	16-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	80-100	<20	NP-10
Mu Munjor	0-8	Sandy loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	95-100	65-100	25-55	15-30	NP-7
	8-32	Fine sandy loam, loam, sandy loam.	SM, SC, ML, CL	A-4	0	100	95-100	65-100	35-65	15-30	3-10
	32-60	Loamy sand, sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	55-100	5-30	---	NP
Pf Penden	0-10	Clay loam	CL	A-6, A-7-6	0	100	100	85-100	65-95	30-45	11-25
	10-33	Clay loam, loam, silty clay loam.	CL	A-6, A-7-6	0	100	100	85-100	60-90	30-45	11-25
	33-60	Clay loam, loam	CL	A-6, A-7-6	0	100	100	75-100	55-75	30-45	11-25
Pk Penden	0-5	Clay loam	CL	A-6, A-7-6	0	100	100	85-100	65-95	30-45	11-25
	5-30	Clay loam, loam, silty clay loam.	CL	A-6, A-7-6	0	100	100	85-100	60-90	30-45	11-25
	30-60	Clay loam, loam	CL	A-6, A-7-6	0	100	100	75-100	55-75	30-45	11-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Po--------------- Penden	0-14	Loam-------------	CL	A-4, A-6	0	100	100	85-100	65-95	25-40	7-20
	14-32	Clay loam, loam, silty clay loam.	CL	A-6, A-7-6	0	100	100	85-100	60-90	30-45	11-25
	32-60	Clay loam, loam	CL	A-6, A-7-6	0	100	100	75-100	55-75	30-45	11-25
Rf--------------- Roxbury	0-24	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	65-100	25-40	7-20
	24-49	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	95-100	80-100	30-50	8-25
	49-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	95-100	65-100	30-50	7-25
Ub, Uc----------- Uly	0-10	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	10-20	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	20-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
Vo--------------- Voda	0-7	Silty clay loam	CL	A-4, A-6, A-7	0	100	100	95-100	80-100	30-50	8-25
	7-24	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0	100	100	95-100	90-100	45-70	20-40
	24-60	Silt loam, very fine sandy loam, fine sandy loam.	CL, CL-ML, ML	A-4	0	100	95-100	80-100	65-95	<30	NP-10
Wb--------------- Wakeen	0-11	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	7-20
	11-30	Silty clay loam, silt loam.	CL, ML	A-6, A-7-6	0	95-100	85-100	75-100	60-95	30-50	10-25
	30-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wp*: Wakeen----------	0-4	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	7-20
	4-33	Silty clay loam, silt loam.	CL, ML	A-6, A-7-6	0	95-100	85-100	75-100	60-95	30-50	10-25
	33-37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Nibson----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-20	85-100	80-95	65-95	60-90	25-40	5-20
	6-14	Silty clay loam, silt loam.	CL	A-6, A-7	0-20	85-95	80-95	60-90	55-90	30-45	10-25
	14-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ap, Ar, As------- Armo	0-16	18-27	1.25-1.40	0.6-2.0	0.21-0.24	6.6-8.4	<2	Low--------	0.28	5	4L	1-3
	16-38	18-35	1.30-1.40	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.28			
	38-60	18-35	1.30-1.45	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low--------	0.28			
Bd*: Badland.												
Manvel----------	0-3	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.9-8.4	<2	Moderate	0.37	5	4L	.5-2
	3-60	18-35	1.35-1.40	0.6-2.0	0.16-0.18	7.9-8.4	2-4	Moderate	0.43			
Bg--------------- Bogue	0-6	50-75	1.10-1.30	<0.06	0.11-0.14	6.6-8.4	<2	High------	0.28	3	4	.5-1
	6-19	60-80	1.30-1.45	<0.06	0.09-0.11	6.6-8.4	<2	High------	0.28			
	19-27	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-7.3	<2	High------	0.28			
	27-40	---	---	---	---	---	---	----------	----			
Br--------------- Brownell	0-8	15-27	1.30-1.45	0.6-2.0	0.10-0.16	7.4-8.4	<2	Low--------	0.20	3	6	.5-1
	8-28	15-27	1.35-1.50	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low--------	0.20			
	28-32	---	---	---	---	---	---	----------	----			
Cc*: Campus----------	0-7	15-27	1.25-1.35	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.28	4	4L	1-2
	7-14	18-35	1.30-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.28			
	14-36	18-35	1.40-1.60	0.6-2.0	0.15-0.19	7.9-8.4	<2	Low--------	0.28			
	36-40	---	---	---	---	---	---	----------	----			
Canlon----------	0-8	12-27	1.30-1.45	0.6-2.0	0.15-0.24	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	8-18	8-27	1.35-1.50	0.6-2.0	0.15-0.22	7.4-8.4	<2	Low--------	0.32			
	18-22	---	---	---	---	---	---	----------	----			
Cf--------------- Carlson	0-4	15-27	1.30-1.40	0.6-2.0	0.19-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	4-24	35-45	1.35-1.50	0.2-0.6	0.14-0.19	6.6-8.4	<2	Moderate	0.43			
	24-60	18-35	1.35-1.50	0.6-2.0	0.16-0.20	7.9-8.4	<2	Low--------	0.43			
Cu--------------- Coly	0-4	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	1-2
	4-60	18-24	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Do--------------- Dorrance	0-11	10-20	1.35-1.45	2.0-6.0	0.14-0.21	6.6-8.4	<2	Low--------	0.28	3	3	1-3
	11-16	5-18	1.50-1.65	6.0-20	0.07-0.12	7.4-8.4	<2	Low--------	0.10			
	16-60	1-7	1.60-1.70	>20	0.02-0.06	7.4-8.4	<2	Low--------	0.10			
Ha--------------- Harney	0-7	22-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	7-27	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	27-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
He*: Harney----------	0-11	22-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	11-27	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	27-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Mento-----------	0-8	15-27	1.30-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low--------	0.37	4	6	1-3
	8-22	35-45	1.35-1.45	0.06-0.2	0.12-0.18	7.4-8.4	<2	High------	0.37			
	22-46	21-35	1.30-1.40	0.2-0.6	0.18-0.20	7.9-8.4	<4	Moderate	0.37			
	46-60	28-35	1.35-1.45	0.2-0.6	0.10-0.18	7.9-8.4	2-8	Moderate	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Hg*:												
Heizer----------	0-6	15-27	1.30-1.45	0.6-2.0	0.10-0.16	7.4-8.4	<2	Low--------	0.24	2	6	.5-1
	6-15	15-27	1.35-1.50	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low--------	0.24			
	15-19	---	---	---	---	---	---	----------	----			
Brownell--------	0-9	15-27	1.30-1.45	0.6-2.0	0.10-0.16	7.4-8.4	<2	Low--------	0.20	3	6	.5-1
	9-24	15-27	1.35-1.50	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low--------	0.20			
	24-28	---	---	---	---	---	---	----------	----			
Hm--------------- Holdrege	0-9	15-25	1.40-1.60	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	1-3
	9-22	28-35	1.20-1.40	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	22-60	15-20	1.40-1.60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.43			
Ho--------------- Hord	0-14	17-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low--------	0.32	5	6	2-4
	14-37	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.1-7.8	<2	Low--------	0.32			
	37-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Hu, Hw----------- Humbarger	0-20	14-27	1.30-1.40	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.28	5	4L	1-3
	20-32	16-35	1.40-1.50	0.6-2.0	0.18-0.20	7.9-8.4	<2	Moderate	0.28			
	32-60	12-32	1.40-1.50	0.6-2.0	0.13-0.20	7.9-8.4	<2	Low--------	0.28			
If--------------- Inavale	0-6	7-18	1.50-1.60	6.0-20	0.10-0.12	6.1-7.8	<2	Low--------	0.15	5	2	.5-1
	6-60	3-10	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	<2	Low--------	0.15			
Mc--------------- McCook	0-16	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	16-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low--------	0.43			
Mu--------------- Munjor	0-8	7-15	1.30-1.40	2.0-6.0	0.14-0.20	7.4-8.4	<2	Low--------	0.24	5	3	.5-1
	8-32	7-15	1.30-1.40	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low--------	0.24			
	32-60	1-5	1.40-1.50	6.0-20	0.06-0.09	7.4-8.4	<2	Low--------	0.24			
Pf--------------- Penden	0-10	28-35	1.30-1.45	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.28	5	4L	1-4
	10-33	24-35	1.35-1.50	0.6-2.0	0.15-0.19	7.9-8.4	<2	Moderate	0.37			
	33-60	24-35	1.30-1.50	0.6-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.37			
Pk--------------- Penden	0-5	28-35	1.30-1.45	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.28	5	4L	1-4
	5-30	24-35	1.35-1.50	0.6-2.0	0.15-0.19	7.9-8.4	<2	Moderate	0.37			
	30-60	24-35	1.30-1.50	0.6-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.37			
Po--------------- Penden	0-14	20-27	1.30-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.28	5	4L	1-4
	14-32	24-35	1.35-1.50	0.6-2.0	0.15-0.19	7.9-8.4	<2	Moderate	0.37			
	32-60	24-35	1.30-1.50	0.6-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.37			
Rf--------------- Roxbury	0-24	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	24-49	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	49-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Ub, Uc----------- Uly	0-10	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	10-20	20-30	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.43			
	20-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Vo--------------- Voda	0-7	27-40	1.40-1.50	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.32	5	4	1-3
	7-24	40-60	1.30-1.45	0.06-0.2	0.09-0.13	7.4-8.4	<2	High-------	0.32			
	24-60	12-20	1.30-1.50	0.6-2.0	0.18-0.24	7.4-8.4	<2	Low--------	0.32			
Wb--------------- Wakeen	0-11	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	4	4L	1-3
	11-30	18-35	1.35-1.50	0.6-2.0	0.18-0.22	7.4-9.0	<2	Moderate	0.43			
	30-34	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Wp*:												
Wakeen----------	0-4	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low-------	0.32	4	4L	1-3
	4-33	18-35	1.35-1.50	0.6-2.0	0.18-0.22	7.4-9.0	<2	Moderate	0.43			
	33-37	---	---	---	---	---	---	----------	----			
Nibson----------	0-6	15-27	1.25-1.35	0.6-2.0	0.20-0.24	7.4-9.0	<2	Low-------	0.32	2	4L	.5-1
	6-14	18-35	1.30-1.40	0.6-2.0	0.18-0.22	7.9-9.0	<2	Moderate	0.32			
	14-18	---	---	---	---	---	---	----------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "very brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
Ap, Ar, As-------- Armo	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
Bd*: Badland.											
Manvel-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Bg--------------- Bogue	D	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
Br--------------- Brownell	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Low.
Cc*: Campus-----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Low.
Canlon-----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Low.
Cf--------------- Carlson	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Cu--------------- Coly	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Do--------------- Dorrance	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
Ha--------------- Harney	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
He*: Harney-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Mento------------	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Hg*: Heizer-----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Low.
Brownell---------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Low.
Hm--------------- Holdrege	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
Ho--------------- Hord	B	Rare--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Hu--------------- Humbarger	B	Frequent----	Very brief	Apr-Sep	>6.0	---	---	>60	---	Low------	Low.
Hw--------------- Humbarger	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Low------	Low.
If--------------- Inavale	A	Frequent----	Very brief	Jan-Jul	>6.0	---	---	>60	---	Moderate	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
Mc----------------- McCook	B	Occasional	Very brief	Apr-Jul	>6.0	---	---	>60	---	Low-------	Low.
Mu----------------- Munjor	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low.
Pf, Pk, Po--------- Penden	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Rf----------------- Roxbury	B	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Ub, Uc------------- Uly	B	None---------	---	---	>6.0	---	---	>60	---	High------	Low.
Vo----------------- Voda	C	Occasional	Long-------	Apr-Sep	0.5-3.0	Apparent	Apr-Sep	>60	---	High------	Low.
Wb----------------- Wakeen	B	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
Wp*:											
Wakeen------------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
Nibson------------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Low-------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

(LL means liquid limit; PI, plasticity index; MD, maximum dry density; and OM, optimum moisture)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--				Percentage smaller than*--			LL	PI	Moisture density	
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			MD	OM
										Pct		Lb/ft3	Pct
Carlson silt loam: (S85KS-195-001)													
Ap----- 0 to 4	CL	A-4	100	100	95	86	38	7	3	31	10	103	17
Bt----- 12 to 20	CL	A-6	100	100	97	90	58	26	13	47	23	97	23
C------ 40 to 60	CL	A-6	100	100	87	73	52	34	21	38	16	106	17
Holdrege silt loam: (S85KS-195-003)													
Ap------ 0 to 5	CL	A-6	100	100	99	95	47	16	8	35	12	97	21
Bt2----- 14 to 22	CL	A-6	100	100	99	96	55	26	16	39	17	102	20
C2------ 50 to 60	ML	A-6	100	100	99	95	47	16	8	37	12	99	21
Humbarger loam: (S85KS-195-002)													
Ap------ 0 to 6	ML	A-4	100	100	94	77	33	9	4	30	8	104	17
AC------ 20 to 32	CL	A-4	100	100	89	67	29	9	4	28	9	111	14
C------- 32 to 60	CL	A-6	100	100	92	73	27	8	5	29	11	109	16
Uly silt loam: (S85KS-195-004)													
A------- 0 to 10	CL	A-6	100	100	96	89	39	11	4	37	14	98	18
Bw------ 10 to 15	CL	A-6	100	100	98	93	45	18	10	42	18	97	21
C------- 20 to 60	CL	A-6	100	100	98	92	42	15	8	40	16	95	21

* The results obtained by engineering analysis may differ from those obtained by USDA analysis of texture because different procedures were used.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Armo	Fine-loamy, mixed, mesic Entic Haplustolls
Bogue	Very fine, montmorillonitic, mesic Udorthentic Pellusterts
Brownell	Loamy-skeletal, carbonatic, mesic Entic Haplustolls
Campus	Fine-loamy, mixed, mesic Typic Calciustolls
Canlon	Loamy, mixed (calcareous), mesic Lithic Ustorthents
Carlson	Fine, montmorillonitic, mesic Typic Argiustolls
Coly	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Dorrance	Sandy, mixed, mesic Entic Haplustolls
Harney	Fine, montmorillonitic, mesic Typic Argiustolls
Heizer	Loamy-skeletal, carbonatic, mesic Lithic Haplustolls
Holdrege	Fine-silty, mixed, mesic Typic Argiustolls
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Humbarger	Fine-loamy, mixed, mesic Cumulic Haplustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Manvel	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Mento	Fine, montmorillonitic, mesic Typic Argiustolls
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
*Nibson	Loamy, carbonatic, mesic, shallow Entic Haplustolls
Penden	Fine-loamy, mixed, mesic Typic Calciustolls
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
Uly	Fine-silty, mixed, mesic Typic Haplustolls
Voda	Clayey over loamy, mixed (calcareous), mesic Aeric Fluvaquents
Wakeen	Fine-silty, carbonatic, mesic Entic Haplustolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol	Map unit	Land capability*	Prime farmland*	Range site
Ap	Armo loam, 1 to 3 percent slopes	IIe	Yes	Limy Upland.
Ar	Armo loam, 3 to 7 percent slopes	IIIe	Yes	Limy Upland.
As	Armo loam, 7 to 15 percent slopes	VIe	No	Limy Upland.
Bd	Badland-Manvel complex, 3 to 20 percent slopes	VIIs	No	
	Badland			---
	Manvel			Chalk Flats.
Bg	Bogue clay, 8 to 25 percent slopes	VIe	No	Blue Shale.
Br	Brownell gravelly loam, 2 to 10 percent slopes	VIe	No	Limy Upland.
Cc	Campus-Canlon loams, 6 to 30 percent slopes	VIe	No	
	Campus			Limy Upland.
	Canlon			Shallow Limy.
Cf	Carlson silt loam, 1 to 3 percent slopes	IIe	Yes	Loamy Upland.
Cu	Coly silt loam, 2 to 6 percent slopes	IIIe	Yes	Limy Upland.
Do	Dorrance sandy loam, 3 to 15 percent slopes	VIs	No	Sands.
Ha	Harney silt loam, 0 to 1 percent slopes	IIc	Yes	Loamy Upland.
He	Harney-Mento silt loams, 1 to 3 percent slopes	IIe	Yes	
	Harney			Loamy Upland.
	Mento			Clay Upland.
Hg	Heizer-Brownell gravelly loams, 5 to 30 percent slopes	VIIs	No	
	Heizer			Shallow Limy.
	Brownell			Limy Upland.
Hm	Holdrege silt loam, 1 to 3 percent slopes	IIe	Yes	Loamy Upland.
Ho	Hord silt loam	IIc	Yes	Loamy Terrace.
Hu	Humbarger loam, channeled	Vw	No	Loamy Lowland.
Hw	Humbarger loam, occasionally flooded	IIw	Yes	Loamy Lowland.
If	Inavale loamy sand, channeled	VIw	No	Sandy Lowland.
Mc	McCook silt loam, occasionally flooded	IIw	Yes	Loamy Lowland.
Mu	Munjor sandy loam, occasionally flooded	IIIw	Yes	Sandy Lowland.
Pf	Penden clay loam, 3 to 7 percent slopes	IIIe	Yes	Limy Upland.
Pk	Penden clay loam, 3 to 7 percent slopes, eroded	IVe	No	Limy Upland.
Po	Penden loam, 7 to 15 percent slopes	VIe	No	Limy Upland.
Rf	Roxbury silt loam	IIc	Yes	Loamy Terrace.
Ub	Uly silt loam, 1 to 3 percent slopes	IIe	Yes	Loamy Upland.
Uc	Uly silt loam, 3 to 6 percent slopes	IIIe	Yes	Loamy Upland.
Vo	Voda silty clay loam, occasionally flooded	IIw	No	Clay Lowland.
Wb	Wakeen silt loam, 1 to 3 percent slopes	IIIe	Yes	Limy Upland.
Wp	Wakeen-Nibson silt loams, 3 to 8 percent slopes	IVe	No	
	Wakeen			Limy Upland.
	Nibson			Limy Upland.

* A soil complex is treated as a single management unit in the land capability and prime farmland columns.

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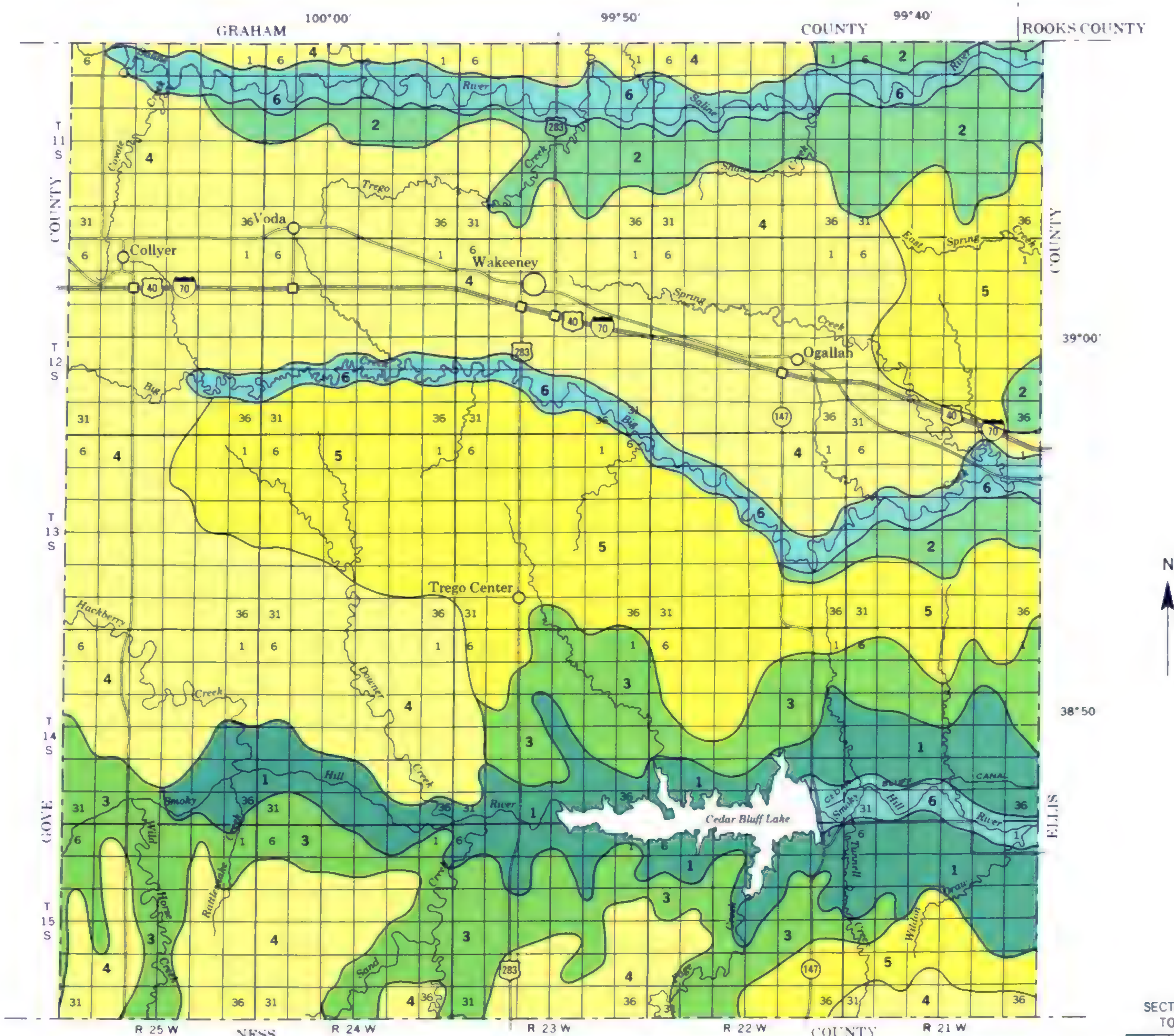


LEGEND

1	ARMO-HEIZER-BROWNELL association: Deep to shallow, moderately sloping to steep, well drained and somewhat excessively drained soils that have a loamy subsoil; on uplands
2	PENDEN-ARMO association: Deep, moderately sloping and strongly sloping, well drained soils that have a loamy subsoil; on uplands
3	ARMO-HARNEY-WAKEEN association: Deep and moderately deep, gently sloping and moderately sloping, well drained soils that have a loamy or silty subsoil; on uplands
4	HARNEY-HOLDREGE association: Deep, nearly level and gently sloping, well drained soils that have a silty subsoil; on uplands
5	CARLSON-PENDEN-HOLDREGE association: Deep, gently sloping and moderately sloping, well drained soils that have a silty or loamy subsoil; on uplands
6	HUMBARGER-MUNJOR-HORD association: Deep, nearly level, well drained soils that have a loamy, silty, or sandy subsoil; on flood plains and stream terraces

COMPILED 1987

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KANSAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

TREGO COUNTY, KANSAS

Scale 1:253,440

1 0 1 2 3 4 Miles

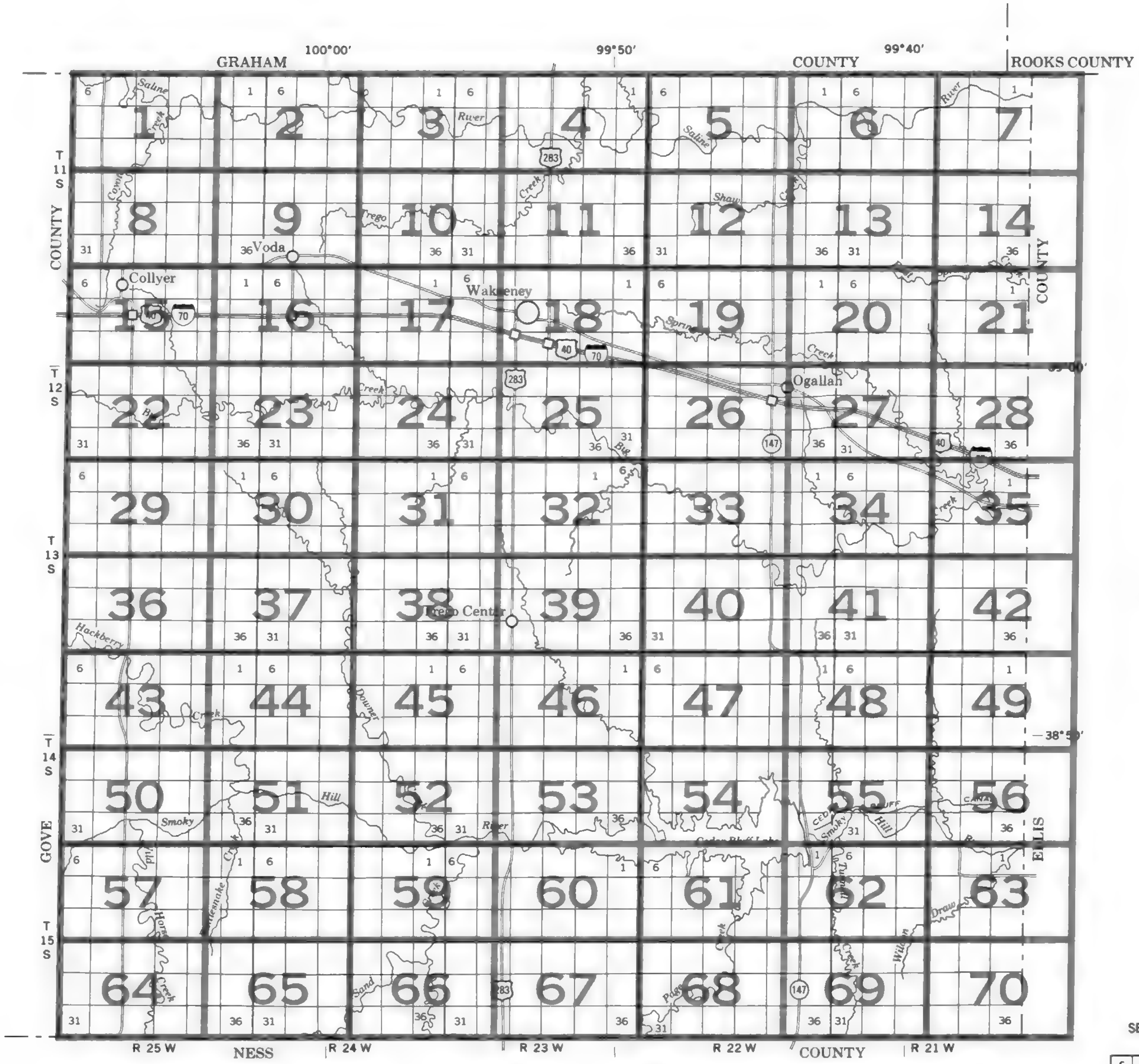
1 0 4 8 Km

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Original text from each individual map sheet read:
This soil map is compiled on 1980 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

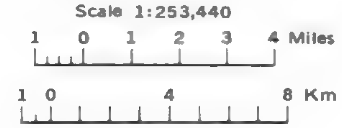


SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
TREGO COUNTY, KANSAS

Scale 1:253,440



SOIL LEGEND

SYMBOL	NAME
Ap	Armo loam, 1 to 3 percent slopes
Ar	Armo loam, 3 to 7 percent slopes
As	Armo loam, 7 to 15 percent slopes
Bd	Badland-Manvel complex, 3 to 20 percent slopes
Bg	Bogue clay, 8 to 25 percent slopes
Br	Brownell gravelly loam, 2 to 10 percent slopes
Cc	Campus-Canlon loams, 6 to 30 percent slopes
Cf	Carlson silt loam, 1 to 3 percent slopes
Cu	Coly silt loam, 2 to 6 percent slopes
Do	Dorrance sandy loam, 3 to 15 percent slopes
Ha	Harney silt loam, 0 to 1 percent slopes
He	Harney-Mento silt loams, 1 to 3 percent slopes
Hg	Heizer-Brownell gravelly loams, 5 to 30 percent slopes
Hm	Holdrege silt loam, 1 to 3 percent slopes
Ho	Hord silt loam
Hu	Humbarger loam, channeled
Hw	Humbarger loam, occasionally flooded
If	Inavale loamy sand, channeled
Mc	McCook silt loam, occasionally flooded
Mu	Munjor sandy loam, occasionally flooded
Pf	Penden clay loam, 3 to 7 percent slopes
Pk	Penden clay loam, 3 to 7 percent slopes, eroded
Po	Penden loam, 7 to 15 percent slopes
Rf	Roxbury silt loam
Ub	Uly silt loam, 1 to 3 percent slopes
Uc	Uly silt loam, 3 to 6 percent slopes
Vo	Vode silty clay loam, occasionally flooded
Wb	Wakeen silt loam, 1 to 3 percent slopes
Wp	Wakeen-Nibson silt loams, 3 to 8 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation
- Siphon

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

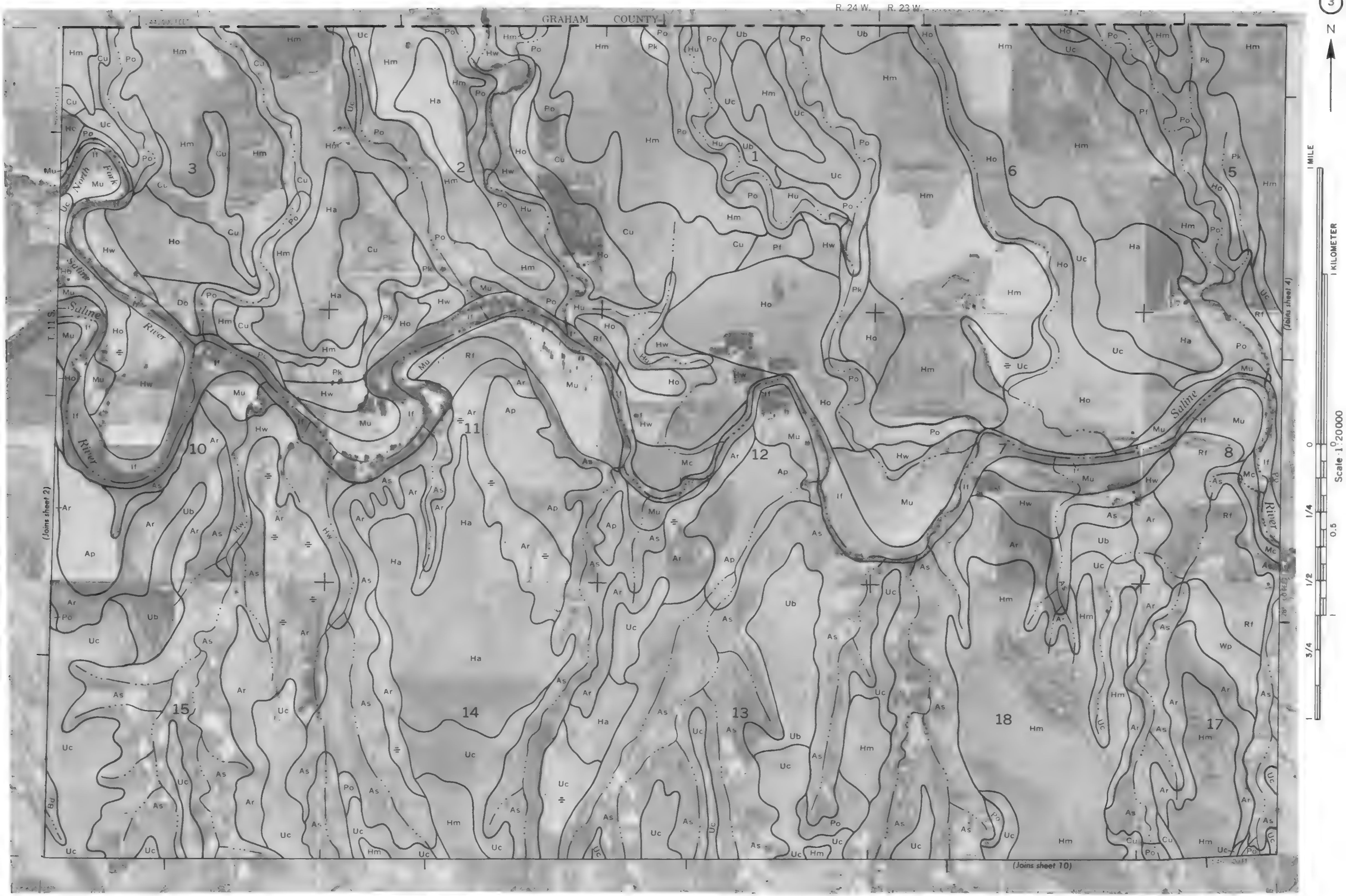
MISCELLANEOUS

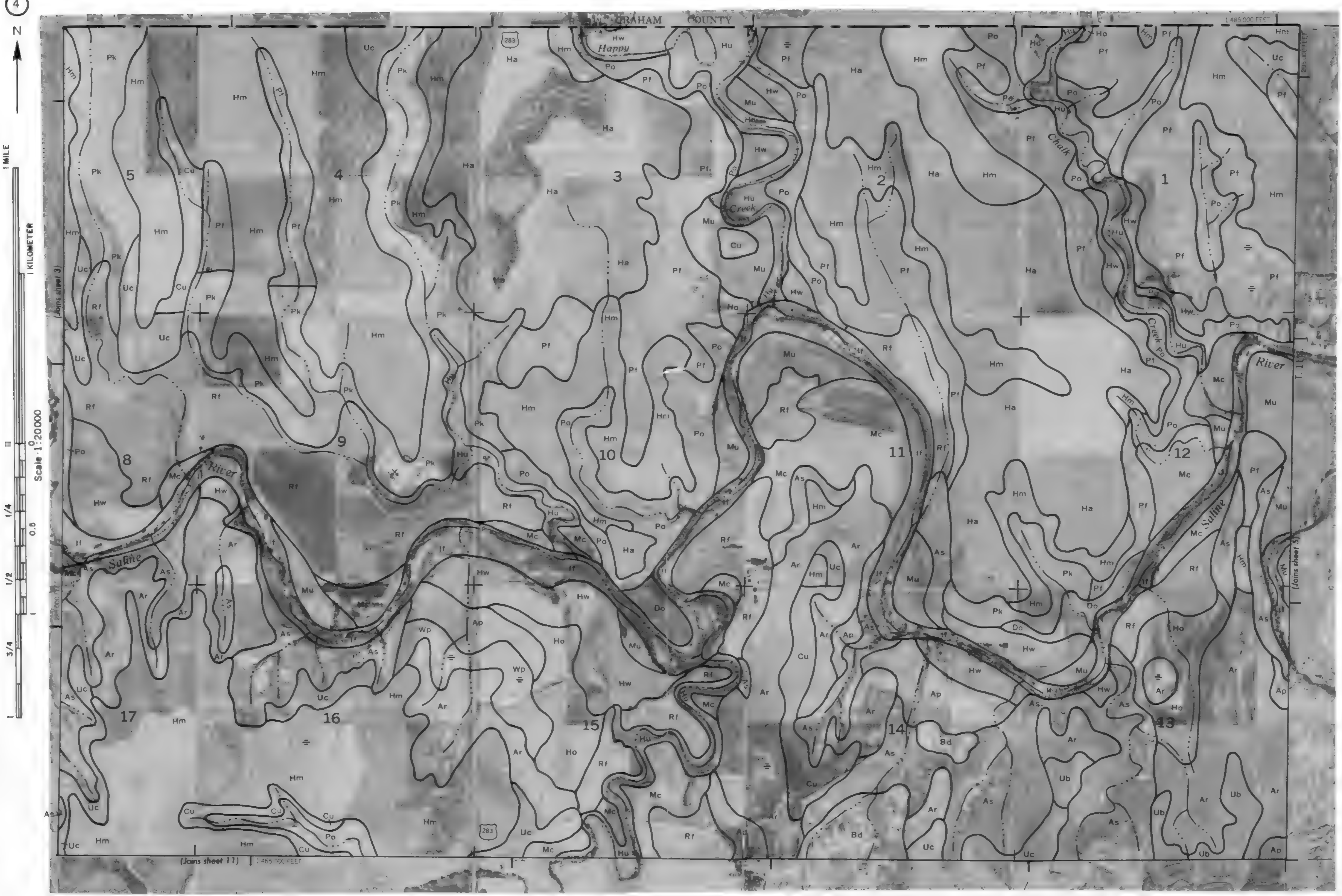
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot


1
N
GRAHAM COUNTY
R 25 W.
GOVE COUNTY
T 11 S
Saline River
Coyote Creek
(Joins sheet 2)
(Joins sheet 8)
1 MILE
1 KILOMETER
Scale 1:20000

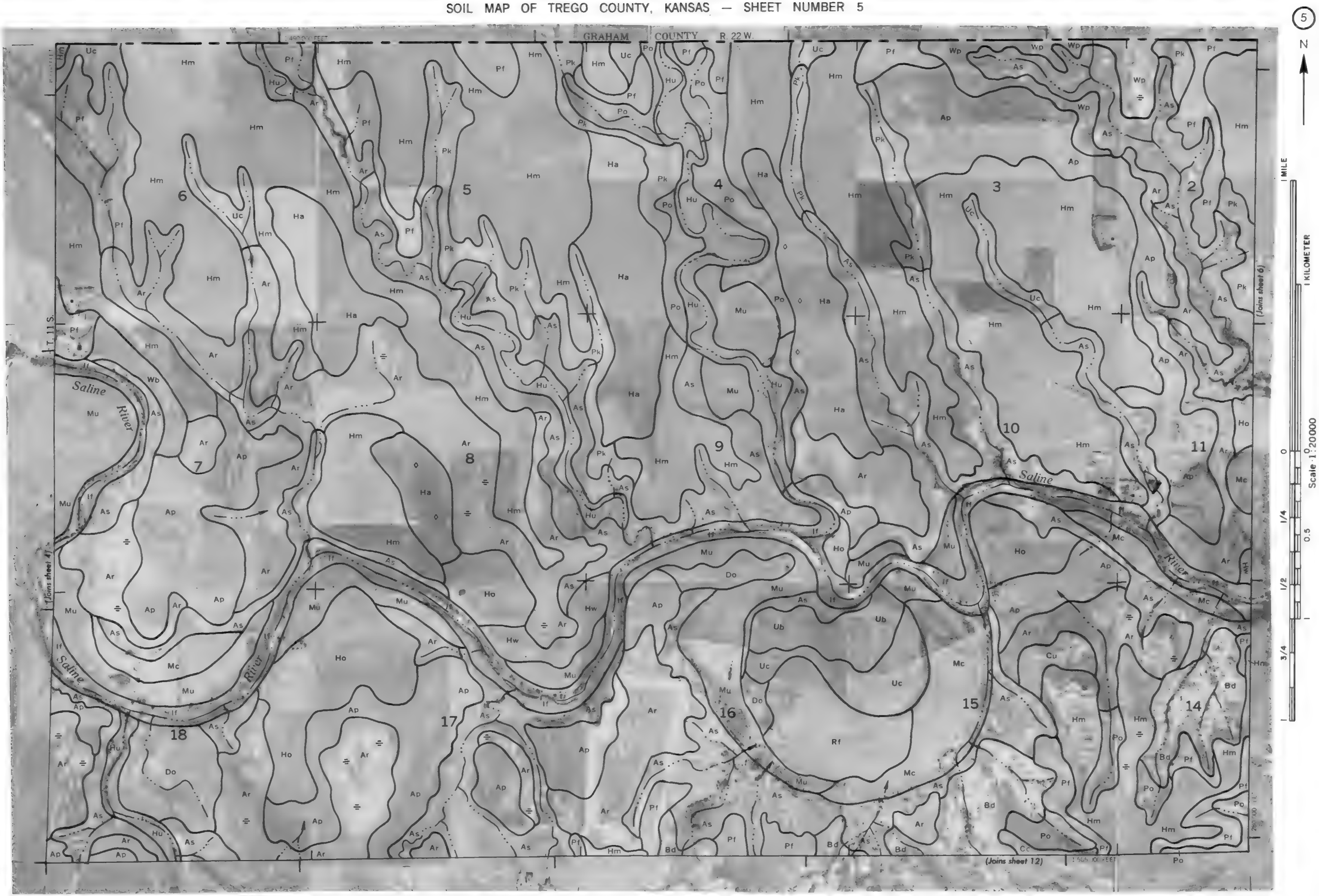

2
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 25 W.
R. 24 W.
GRAHAM COUNTY
North Fork
Saline River
Saline River
Saline River
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 9)
water

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 3

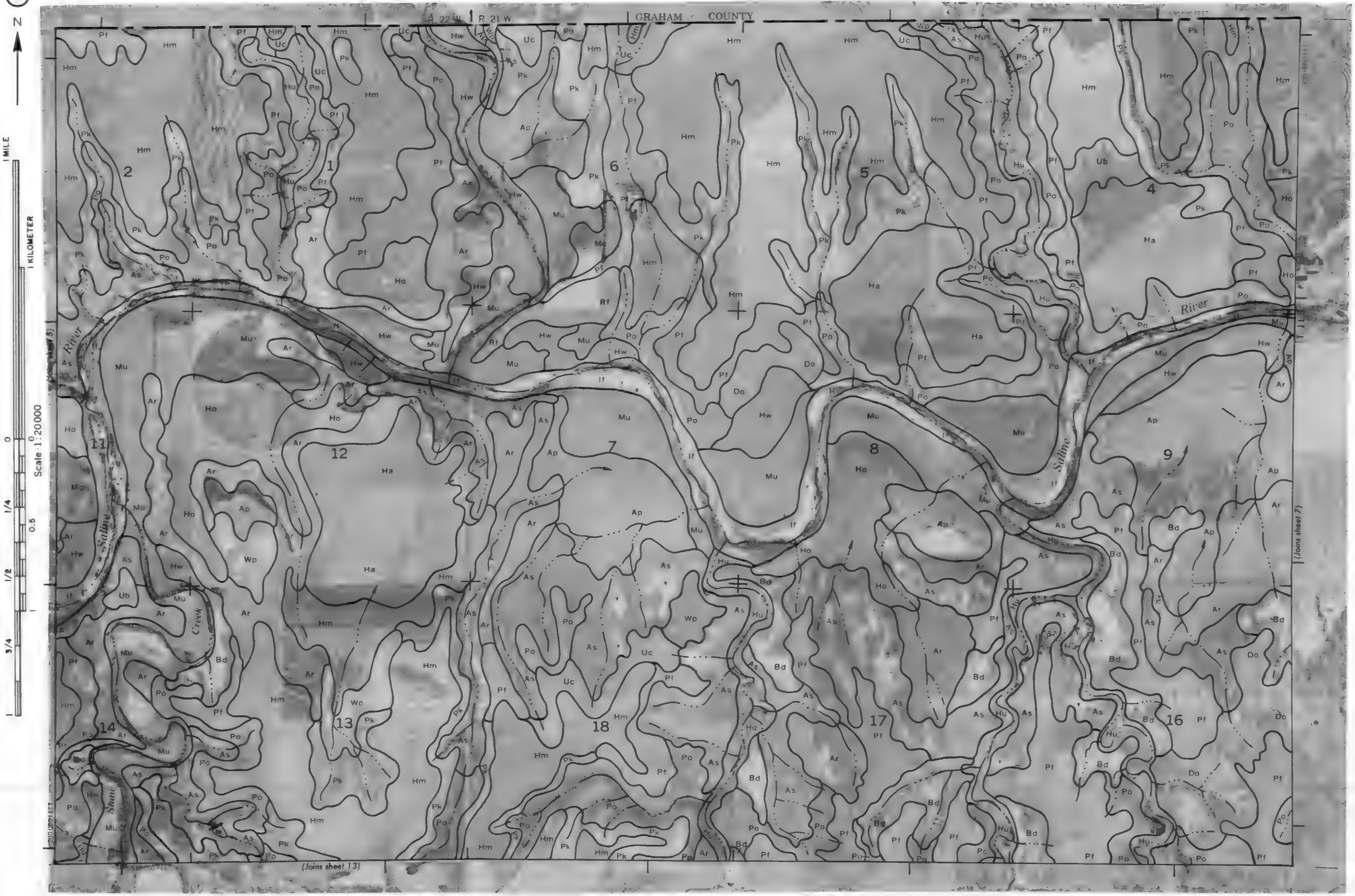



4
N
1 MILE
1 KILOMETER
Scale 1:20000
GRAHAM COUNTY
Happy Creek
Chalk Creek
Saline River
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
1 485 000 FEET
283

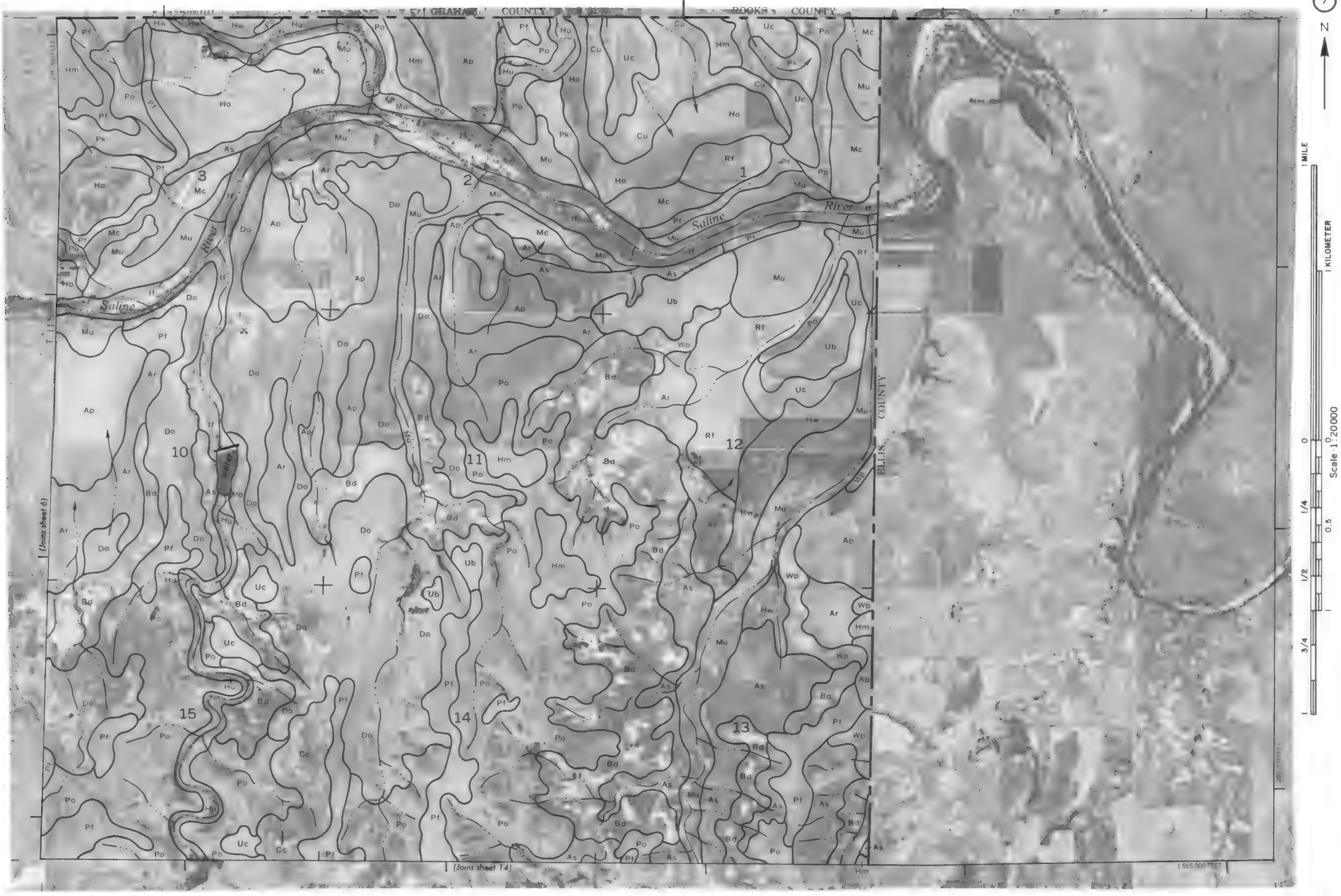
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 5



6


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
R. 22 W.
R. 21 W.
GRAHAM COUNTY
Saline River
River
Creek
Shaw
(Joins sheet 7)
(Joins sheet 13)
(Joins sheet 5)

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 7



SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 8


(Joins sheet 2)
R. 25 W.
R. 24 W.
T. 11 S.
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 16)
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
270 000 FEET
2 435 000 FEET
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
Trego
Creek
Water
Vesta
RAILROAD


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 3)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
R. 24 W.
R. 23 W.
T. 11 S.
1 480 000 FEET
1 440 000 FEET
280 000 FEET
270 000 FEET
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
Trego Creek
Ha
Hm
Cu
Uc
Po
As
Hu
Hw
Cc
Pk
Ub
Bd

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 11

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 12


(Joins sheet 6)
(Joins sheet 14)
(Joins sheet 20)
(Joins sheet 12)
R. 22 W.
R. 21 W.
T. 11 S.
Shaw Creek
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

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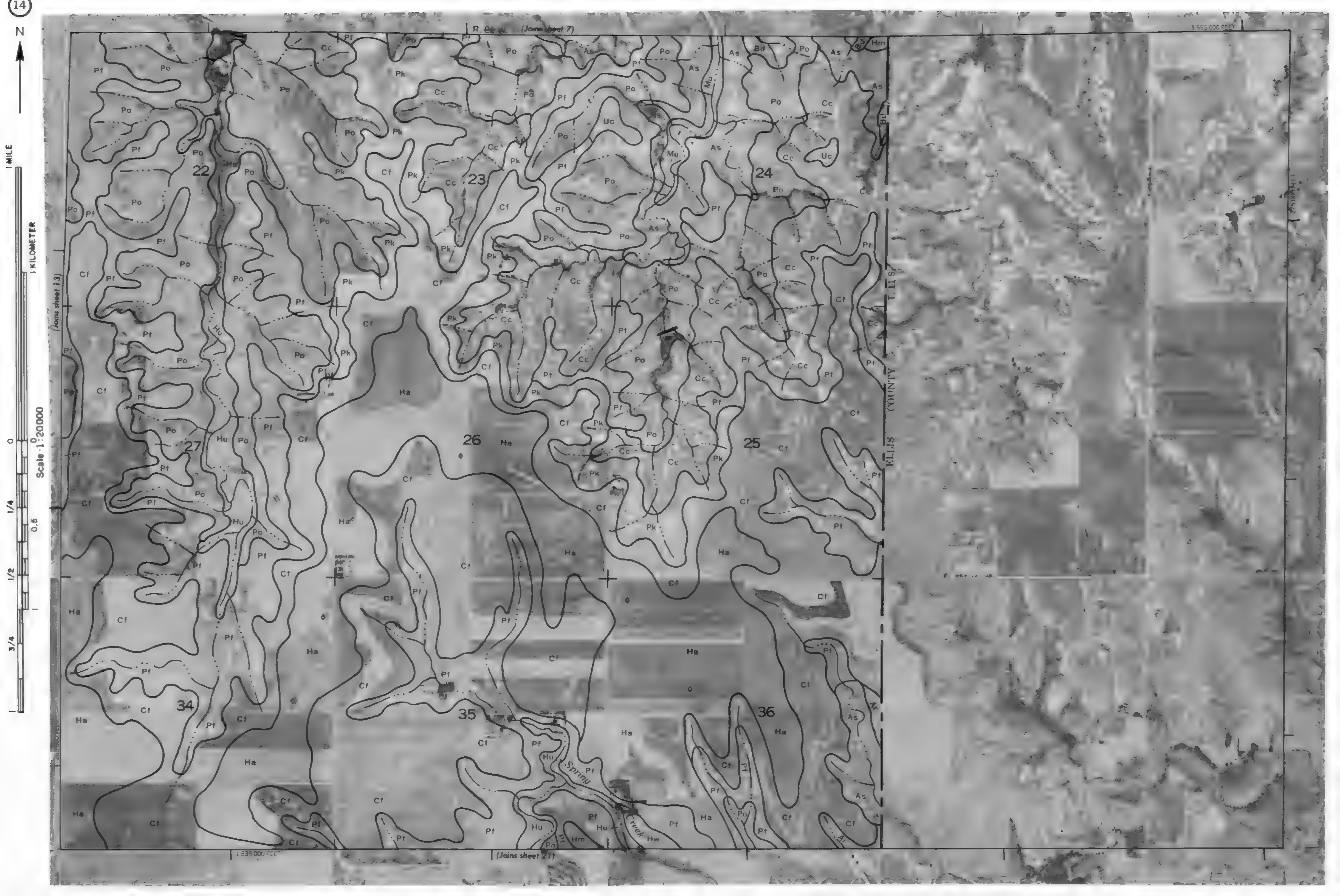

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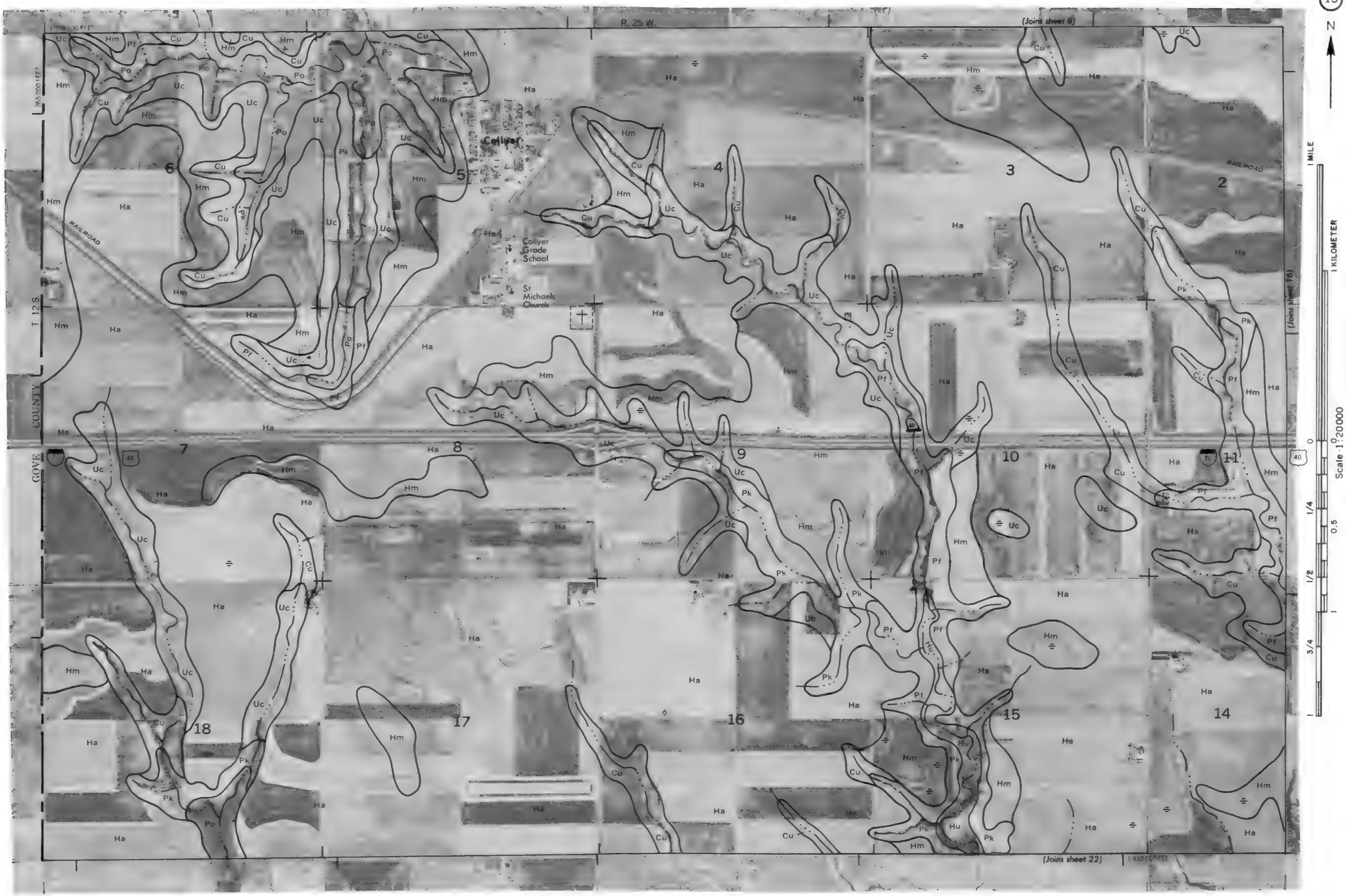
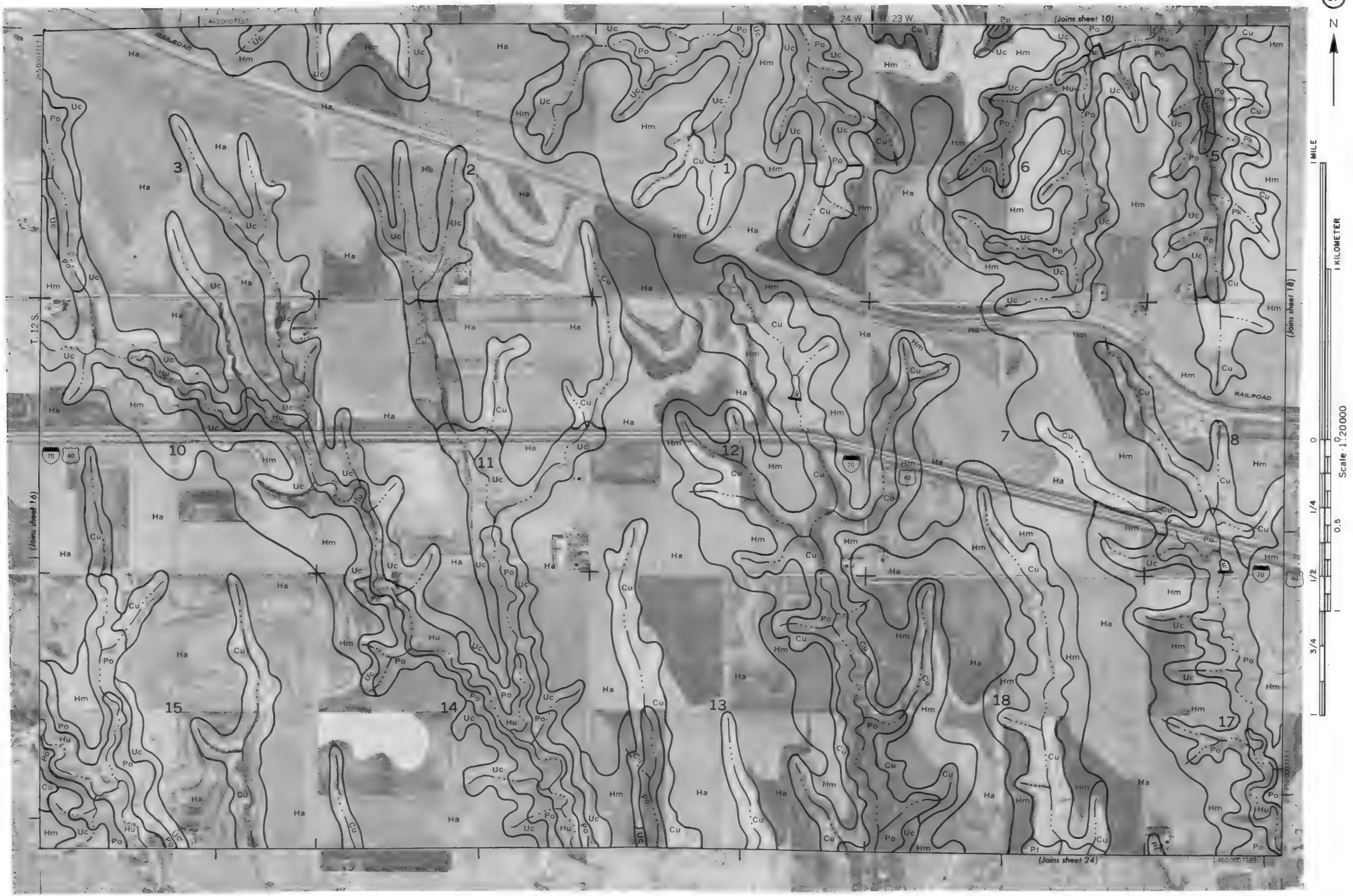


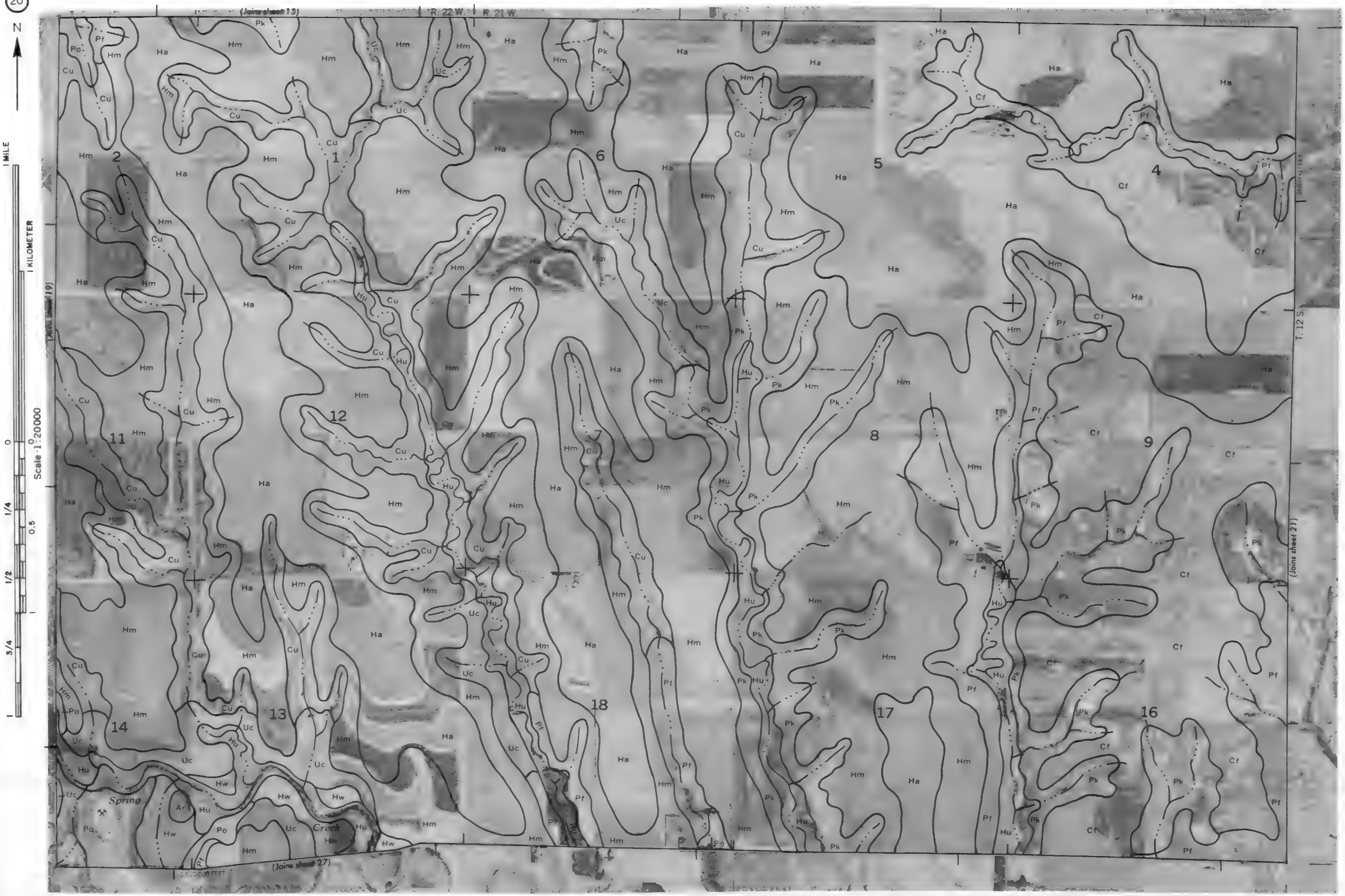

16
N
(Joins sheet 9)
R. 25 W.
R. 24 W.
RAILROAD
RAILROAD
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 23)
T. 12 S.
70
40
Scale 1:20000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
1
2
3
4
5
6
7
8
9
11
12
13
14
16
17
18

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 17

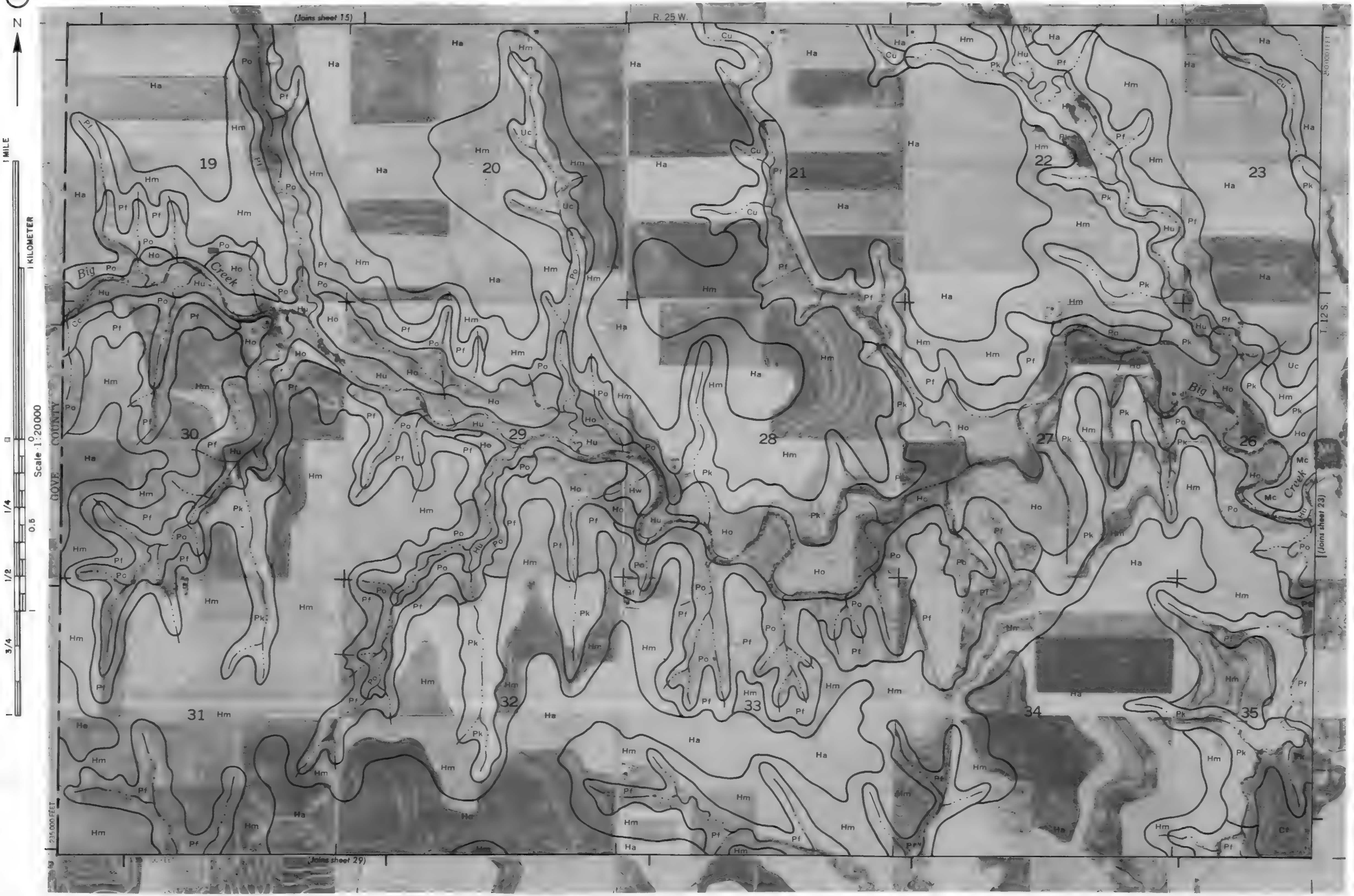



N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 11)
R. 23 W.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
T. 12 S.
WAKEENEY
(county seat)
RAILROAD
Spring Creek


(Joins sheet 12)
(Joins sheet 20)
(Joins sheet 26)
(Joins sheet 18)
R. 22 W.
T. 12 S.
1 485 000 FEET
1 505 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
Spring Creek
Spring
Creek
Water
RAILROAD
R R
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
Ha
Hm
Hu
Pk
Pf
Po
Pc
Uc
Cu
Cf


20
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 13)
R. 22 W.
R. 21 W.
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
T. 12 S.
Spring Creek

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 21


N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 15)
R. 25 W.
T. 12 S.
(Joins sheet 23)
(Joins sheet 29)
GOVE COUNTY
Big Creek
Big Creek
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

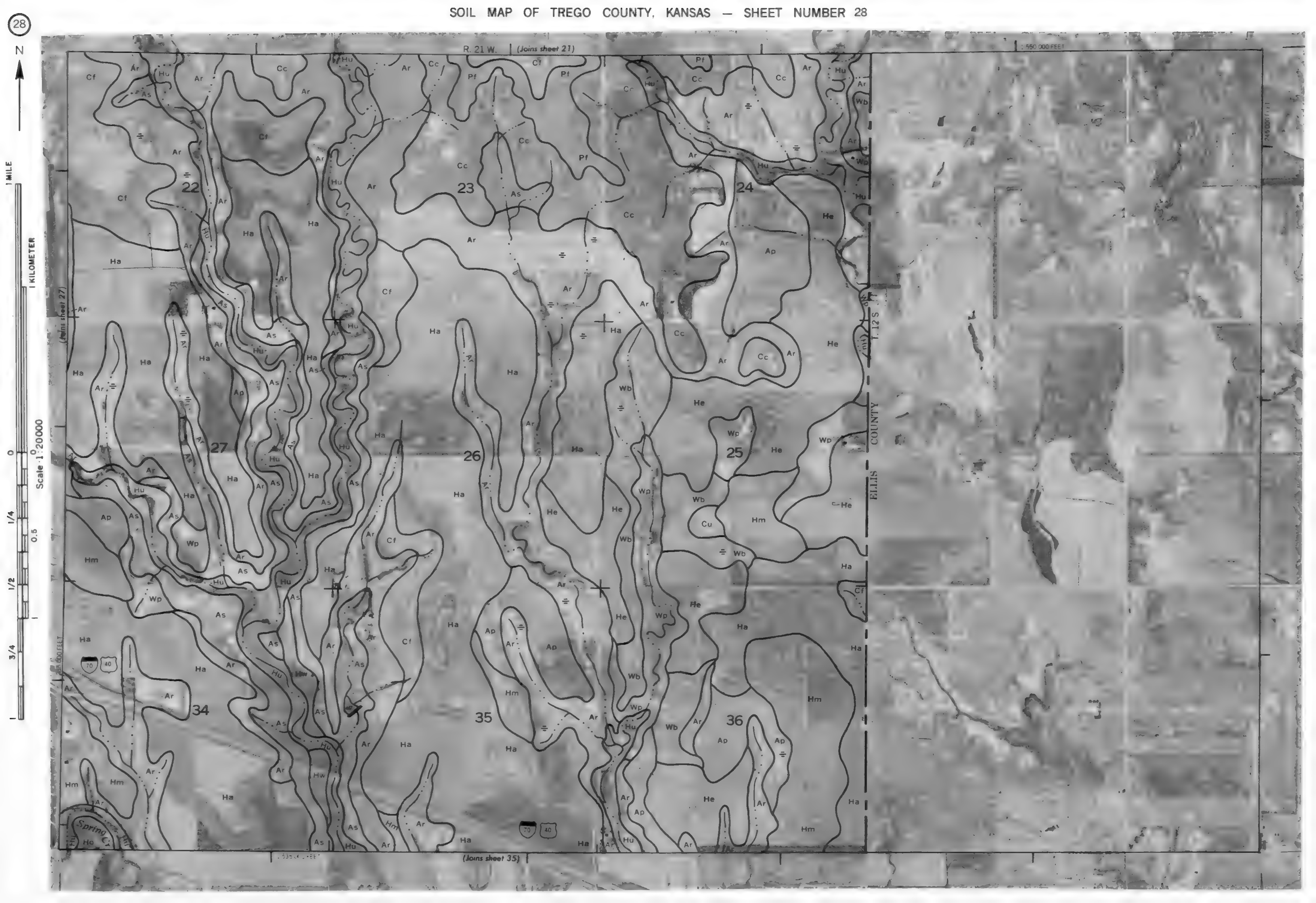
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 23

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 24

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 25

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 26

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 27


28
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 21 W.
(Joins sheet 21)
(Joins sheet 27)
(Joins sheet 35)
T. 12 S.
ELLIS COUNTY
22
23
24
25
26
27
34
35
36
Spring Cr.
70
40

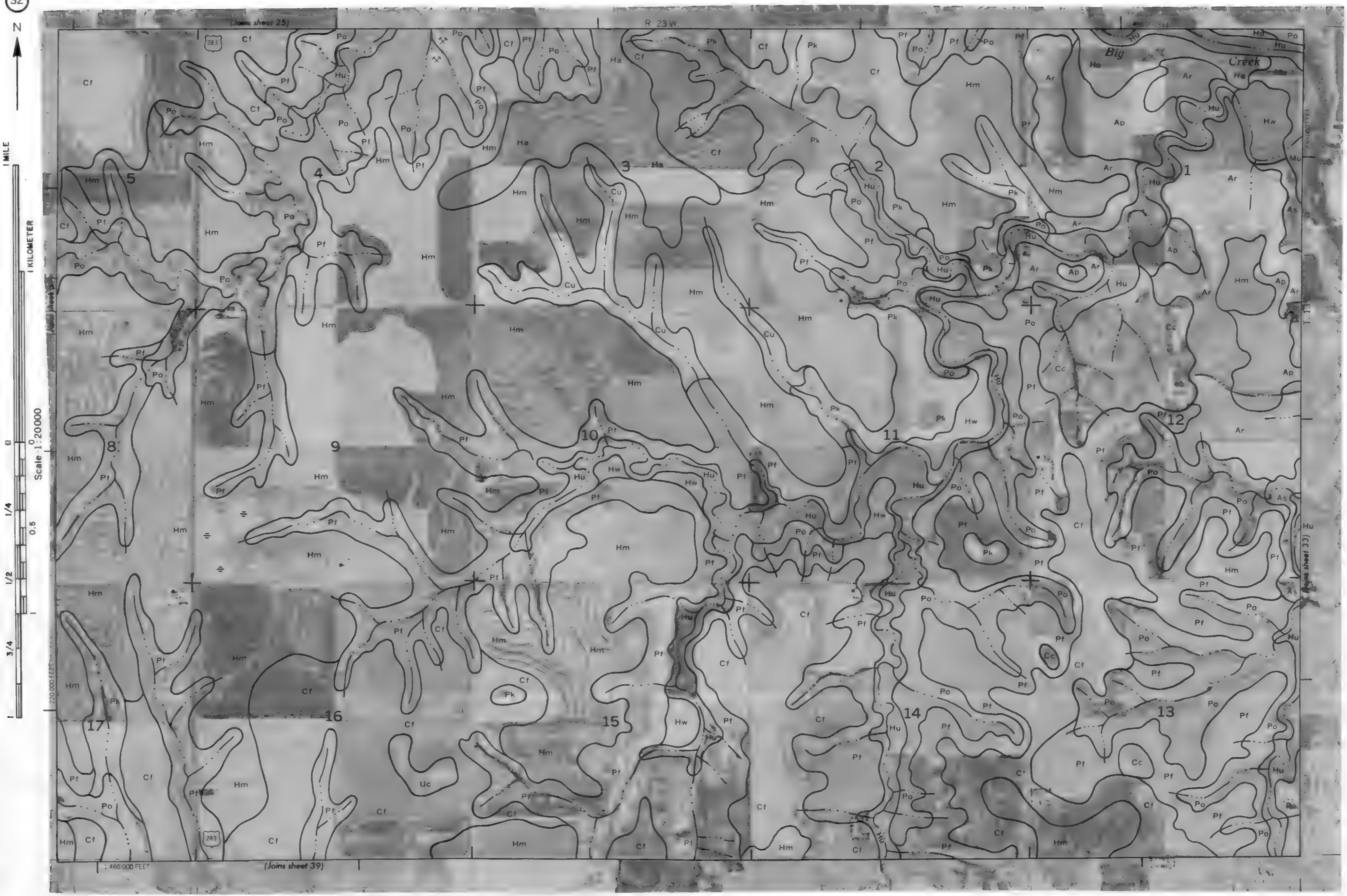
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 29

29

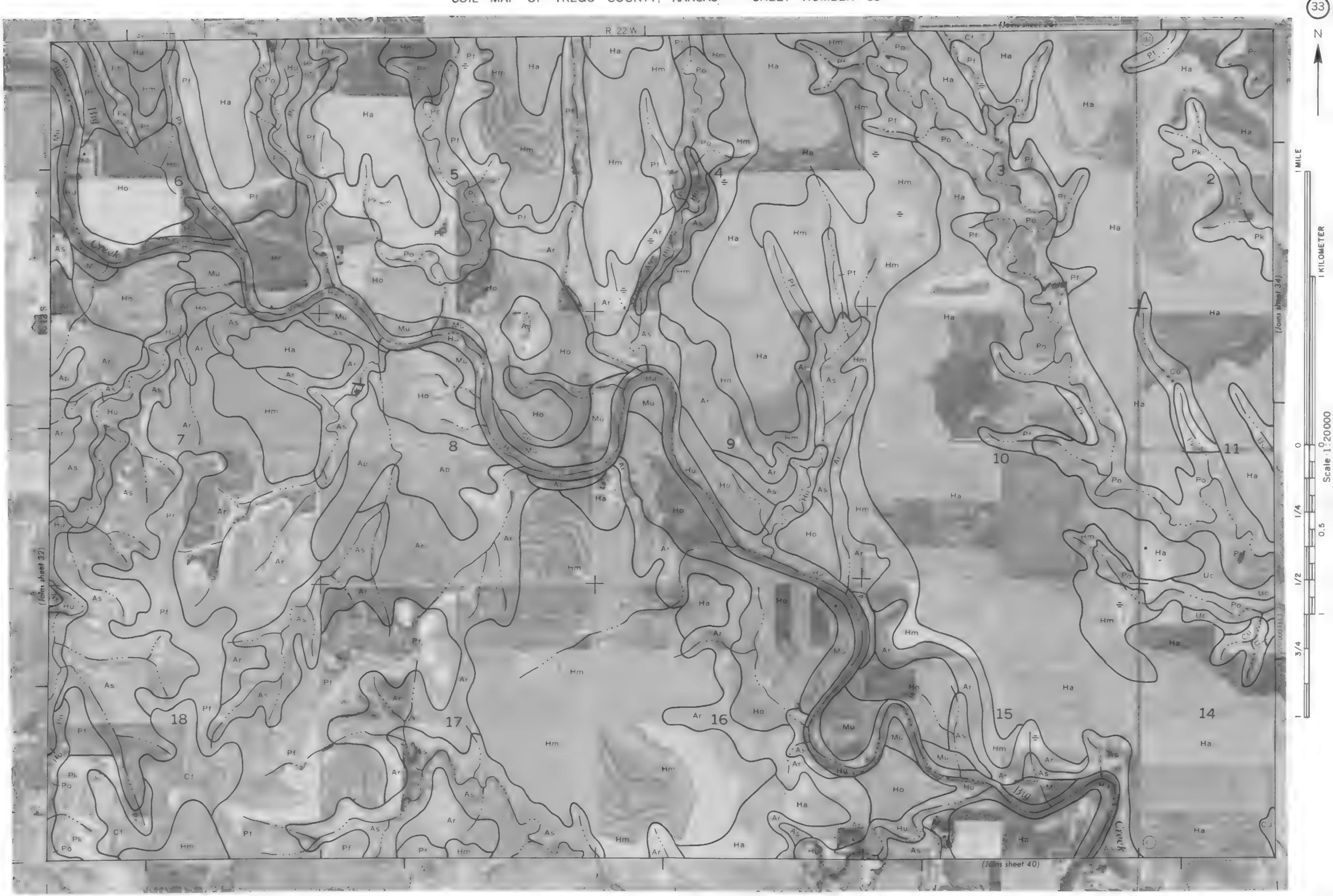
(30)

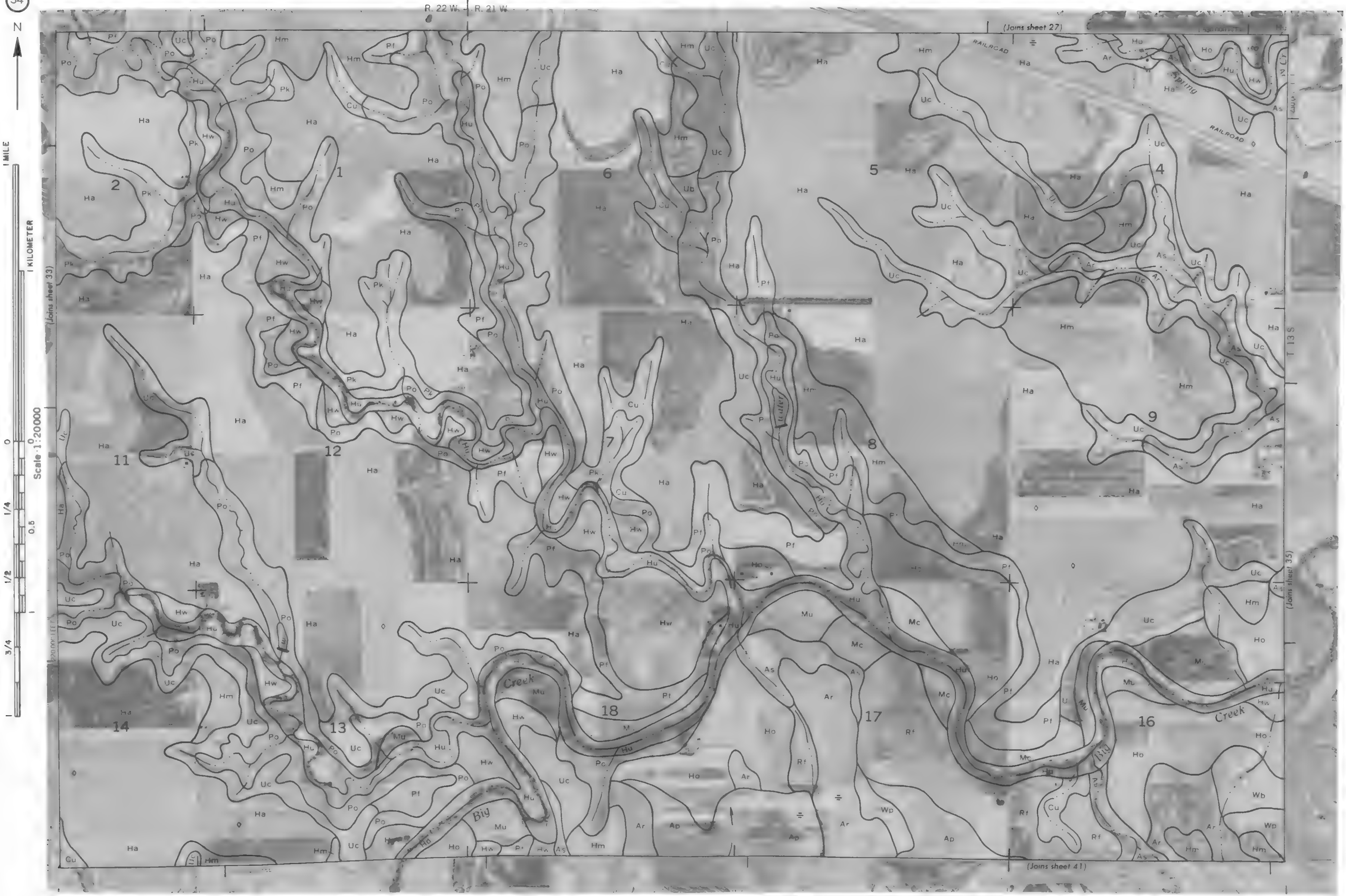
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 30


31
N
(Joins sheet 24)
R. 24 W. | R. 23 W.
(Joins sheet 32)
(Joins sheet 30)
(Joins sheet 38)
T. 13 S.
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 17 18
Cf Ha Hm Pf Pk Po Hu Hw Ub Cu


32
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 25)
R 23 W.
Big Creek
(Joins sheet 33)
(Joins sheet 39)
460 000 FEET
220 000 FEET
283
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

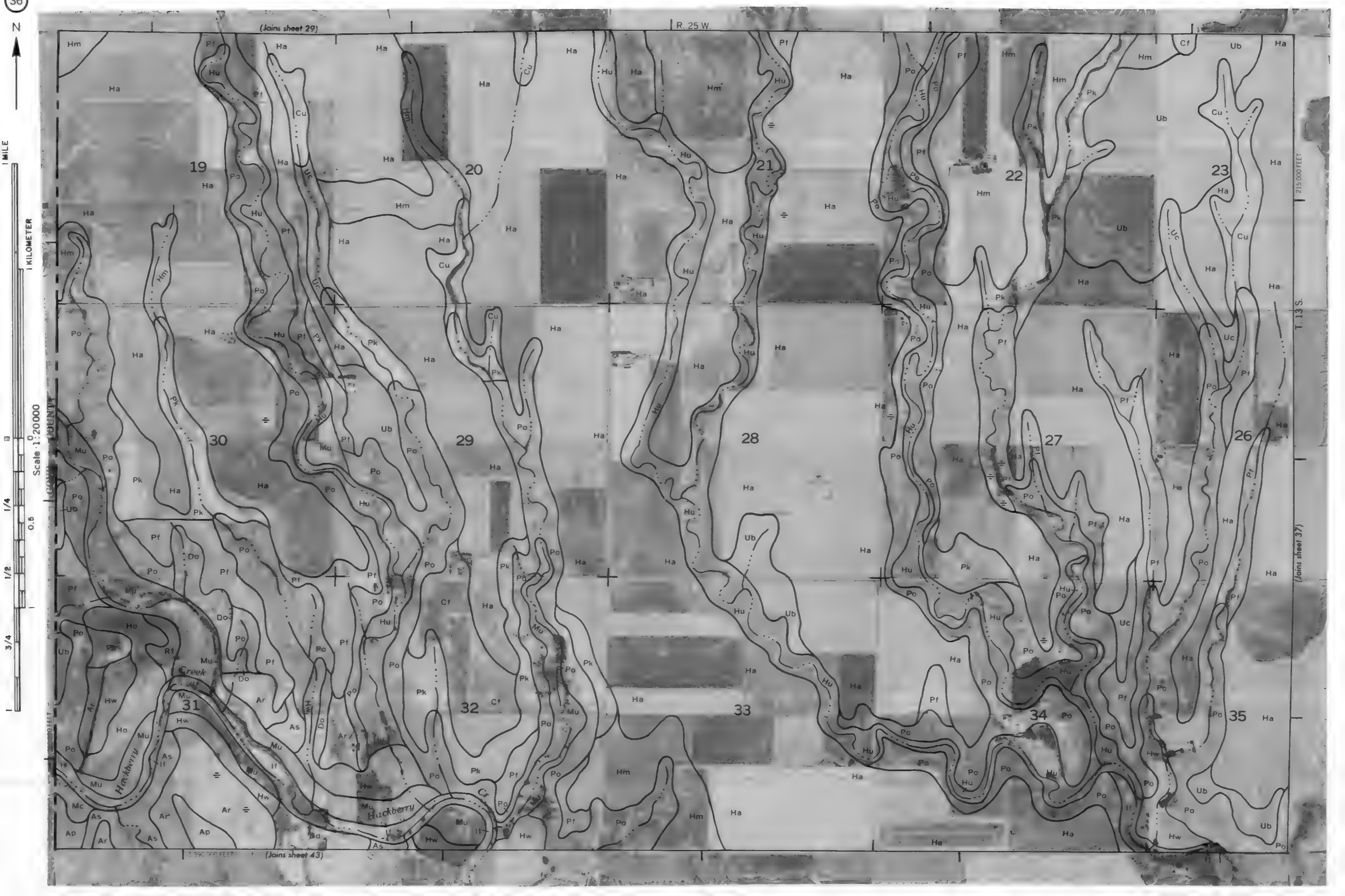
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 33



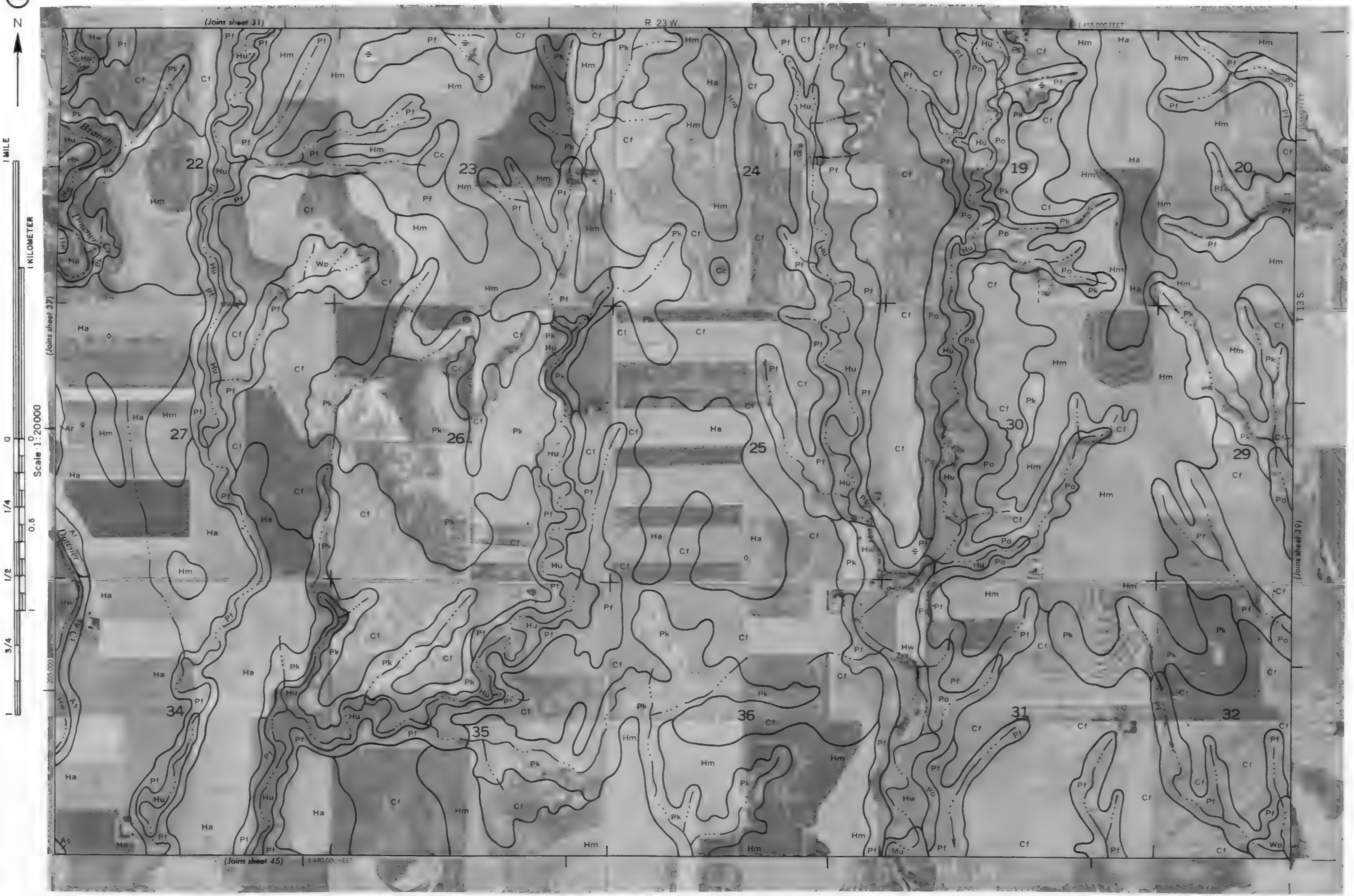

N
1 MILE
1 KILOMETER
Scale 1:20000
R. 22 W.
R. 21 W.
T 13 S
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
RAILROAD
RAILROAD
Spring
Big
Creek
Big
Creek
Big
Creek
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18


35
N
R. 21 W.
(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 42)
T 13 S.
RAILROAD
Spring Creek
Big Creek
ELLIS COUNTY
1 MILE
1 KILOMETER
Scale 1:20000

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 36



SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 37

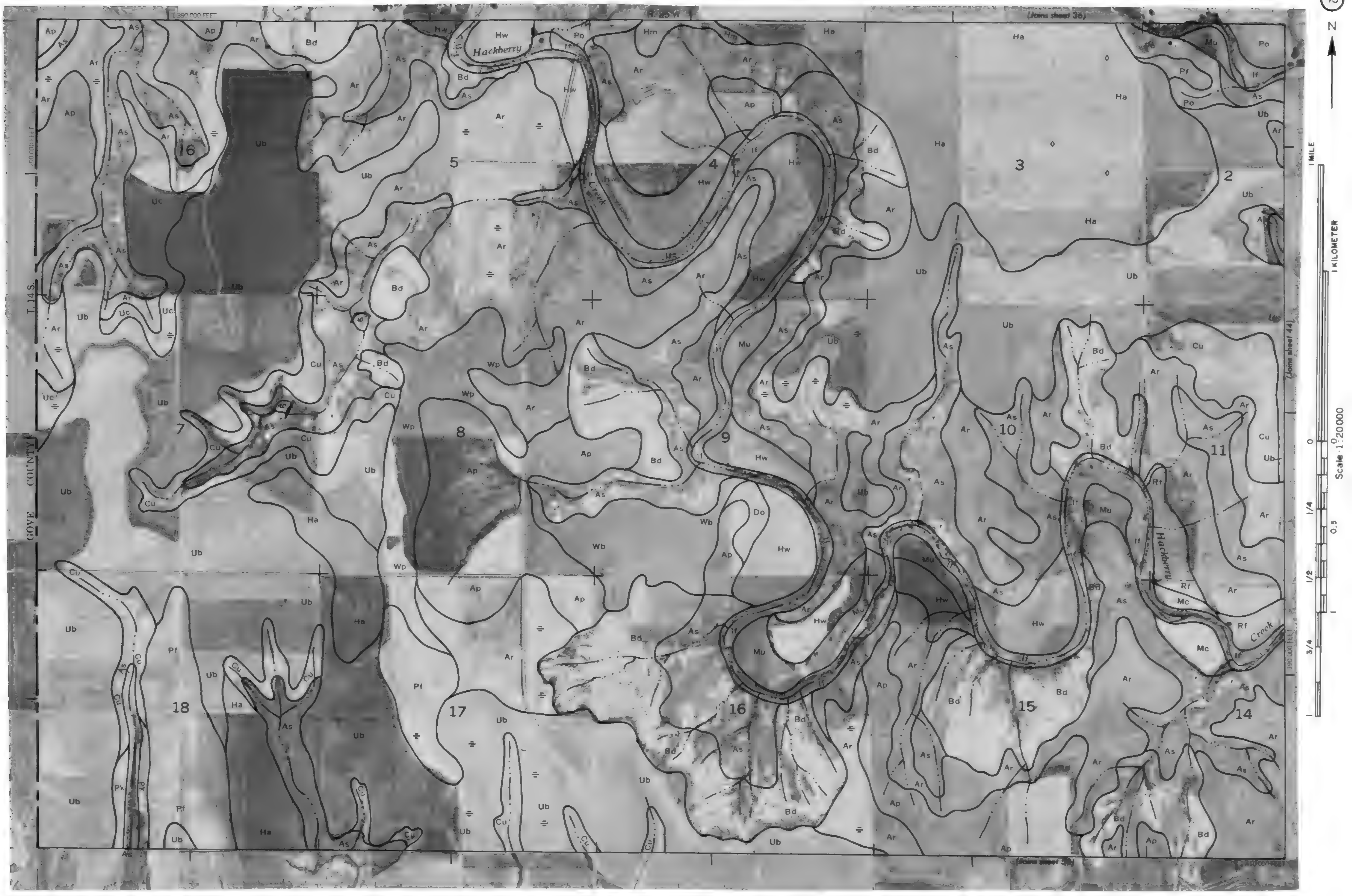

N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 31)
R. 23 W.
1 455 000 FEET
(Joins sheet 37)
(Joins sheet 39)
T. 13 S.
(Joins sheet 45)
Branch
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32


R. 23 W.
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
1 460 000 FEET
1 480 000 FEET
213 000 FEET
T. 13 S.
283
Zion Church
Trego Center
Water
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/8
1/4
3/4
0.5

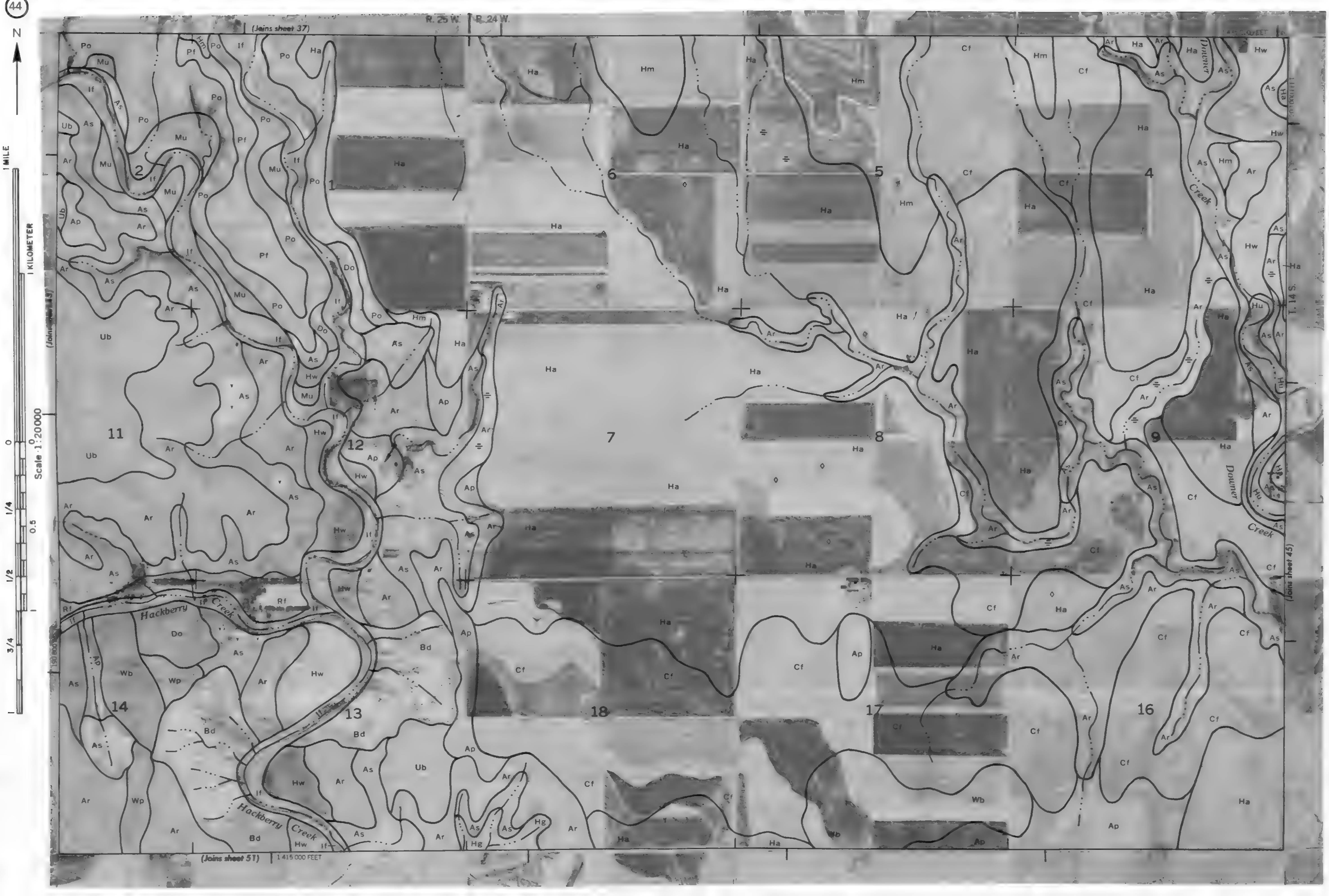
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 40

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 41


42
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 35)
R. 21 W.
(Joins sheet 49)
ELLIS COUNTY
T. 13 S.
22
23
24
25
26
27
34
35
36


1 390 000 FEET
R. 25 W.
(Joins sheet 36)
(Joins sheet 44)
T. 14 S.
GOVE COUNTY
Hackberry Creek
Hackberry Creek
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
1
2
3
4
5
7
8
9
10
11
14
15
16
16
17
18

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 44



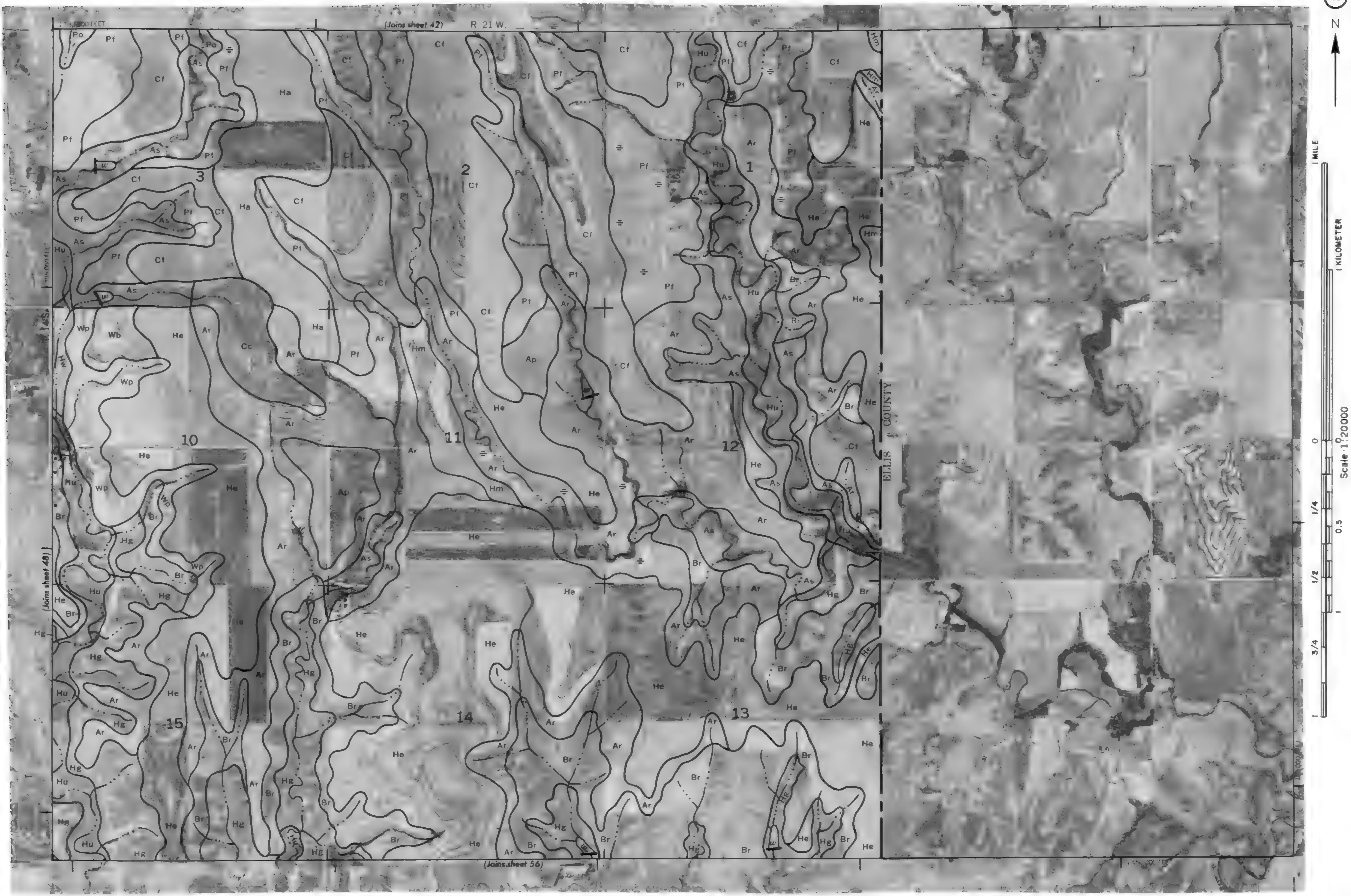

45
N
R. 24 W.
R. 23 W.
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 44)
T. 14 S.
Downer Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 46

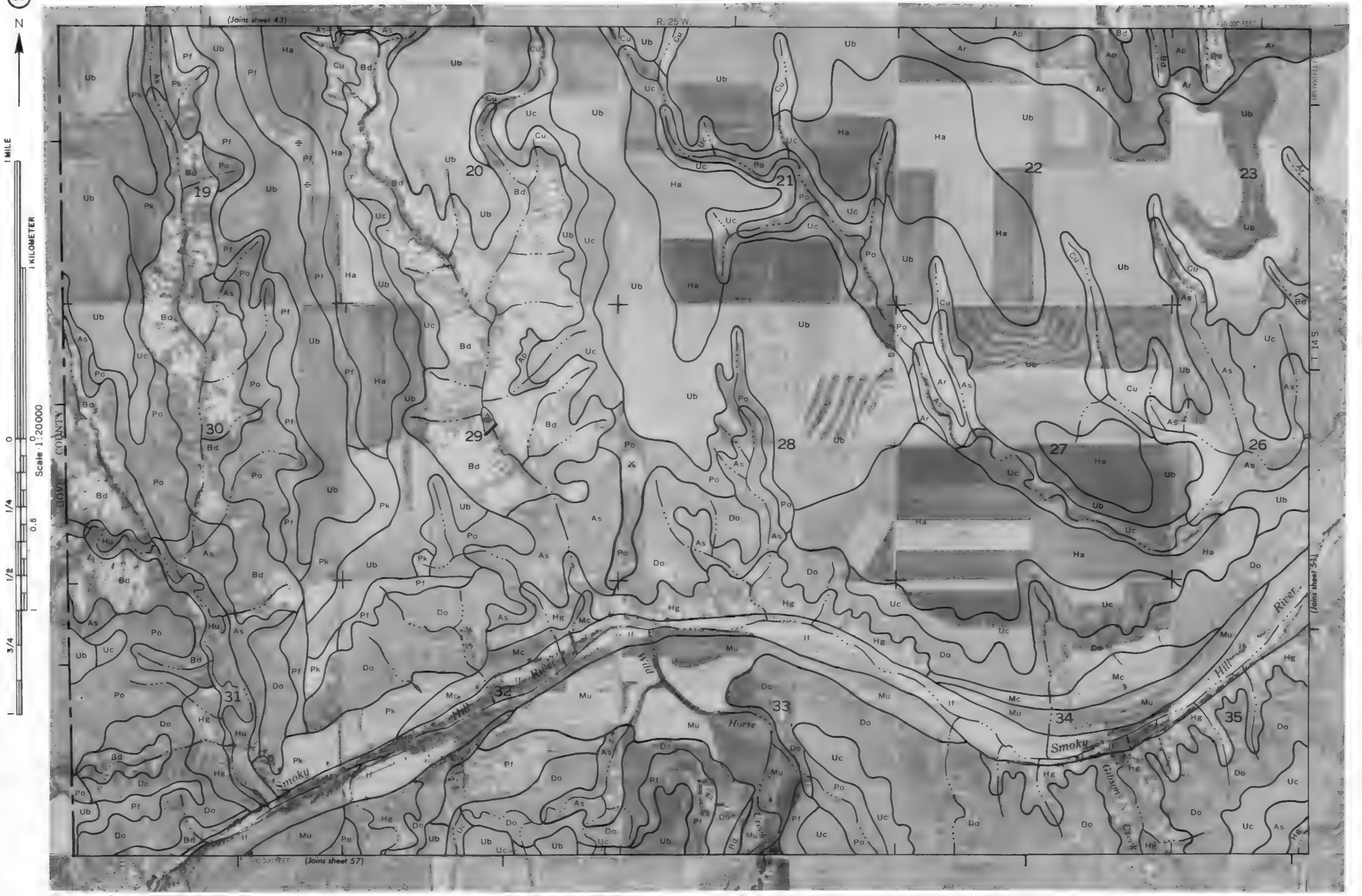
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 47

47

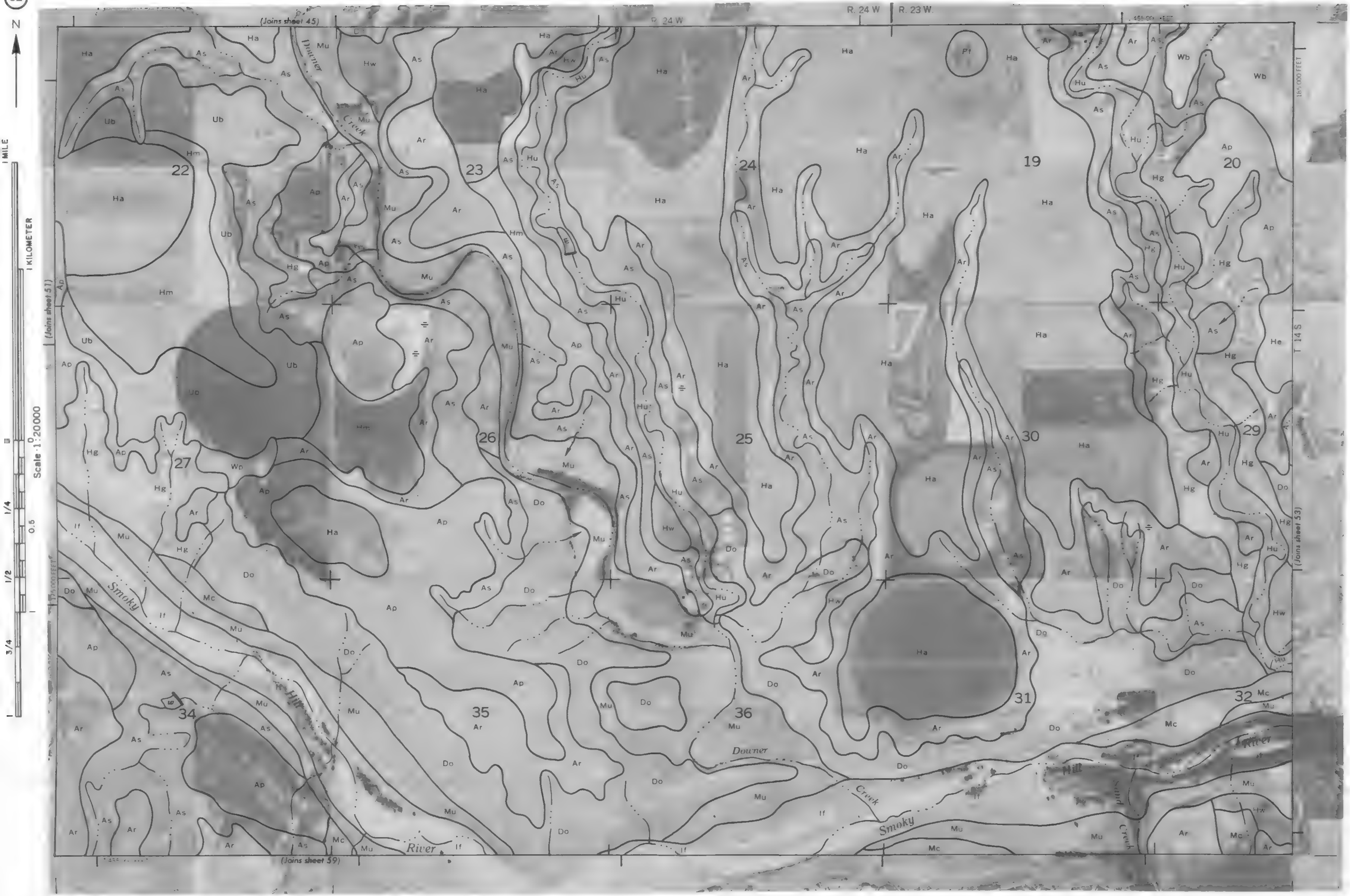
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 48


(Joins sheet 42)
R 21 W.
(Joins sheet 48)
(Joins sheet 56)
ELLIS COUNTY
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 50



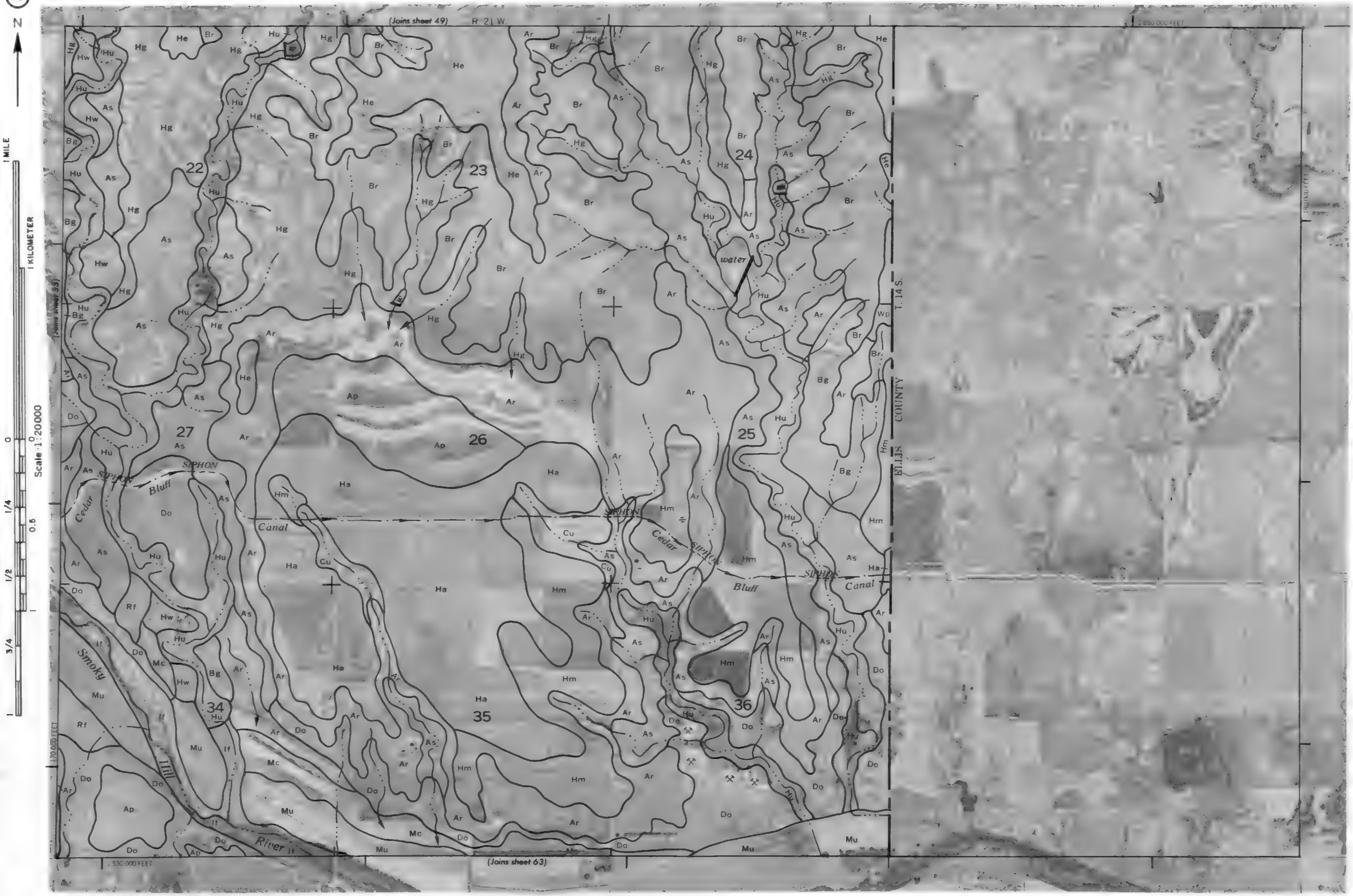

R. 25 W.
R. 24 W.
1 415 000 FEET
(Joins sheet 44)
185 000 FEET
T. 14 S.
Hackberry
Creek
Smoky
Hill
River
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 58)
175 000 FEET
1 430 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
(Joins sheet 45)
R. 24 W
R. 24 W.
R. 23 W.
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 59)
T. 14 S.
Downer Creek
Smoky Hill River
Smoky River
Downer Creek
Smoky Hill River
Sand Creek
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36


53
N
R. 23 W.
(Joins sheet 46)
(Joins sheet 54)
(Joins sheet 60)
(Joins sheet 52)
T. 14 S.
1 MILE
1 KILOMETER
Scale 1:20000
CEDAR
BLUFF
STATE
GAME
MANAGEMENT
AREA
Smoky
Hill
River


N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 47)
R. 22 W.
(Joins sheet 55)
T. 14 S.
(Joins sheet 61)
(Joins sheet 53)
485 000 FEET
CEDAR BLUFF STATE GAME MANAGEMENT AREA
CEDAR BLUFF STATE GAME MANAGEMENT AREA
CEDAR BLUFF RESERVOIR
Smoky Hill River
water
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35


(Joins sheet 48)
(Joins sheet 56)
(Joins sheet 62)
R. 22 W.
R. 21 W.
T. 14 S.
CEDAR BLUFF RESERVOIR
CEDAR BLUFF DAM
CEDAR BLUFF STATE GAME MANAGEMENT AREA
Cedar Bluff Canal
SIPHON
Smoky Hill River
Tunnell Cr
N
1 MILE
1 KILOMETER
Scale 1:20000


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 49)
R. 21 W.
(Joins sheet 55)
(Joins sheet 63)
T. 14 S.
ELLIS COUNTY
530 000 FEET
550 000 FEET
120 000 FEET
22
23
24
25
26
27
34
35
36
water
SIPHON
Cedar Bluff Canal
Cedar Bluff Canal
Smoky Hill River
As
Ar
Ap
Bg
Br
Cu
Do
Ha
He
Hg
Hm
Hu
Hw
If
Mc
Mu
Rf
Wp

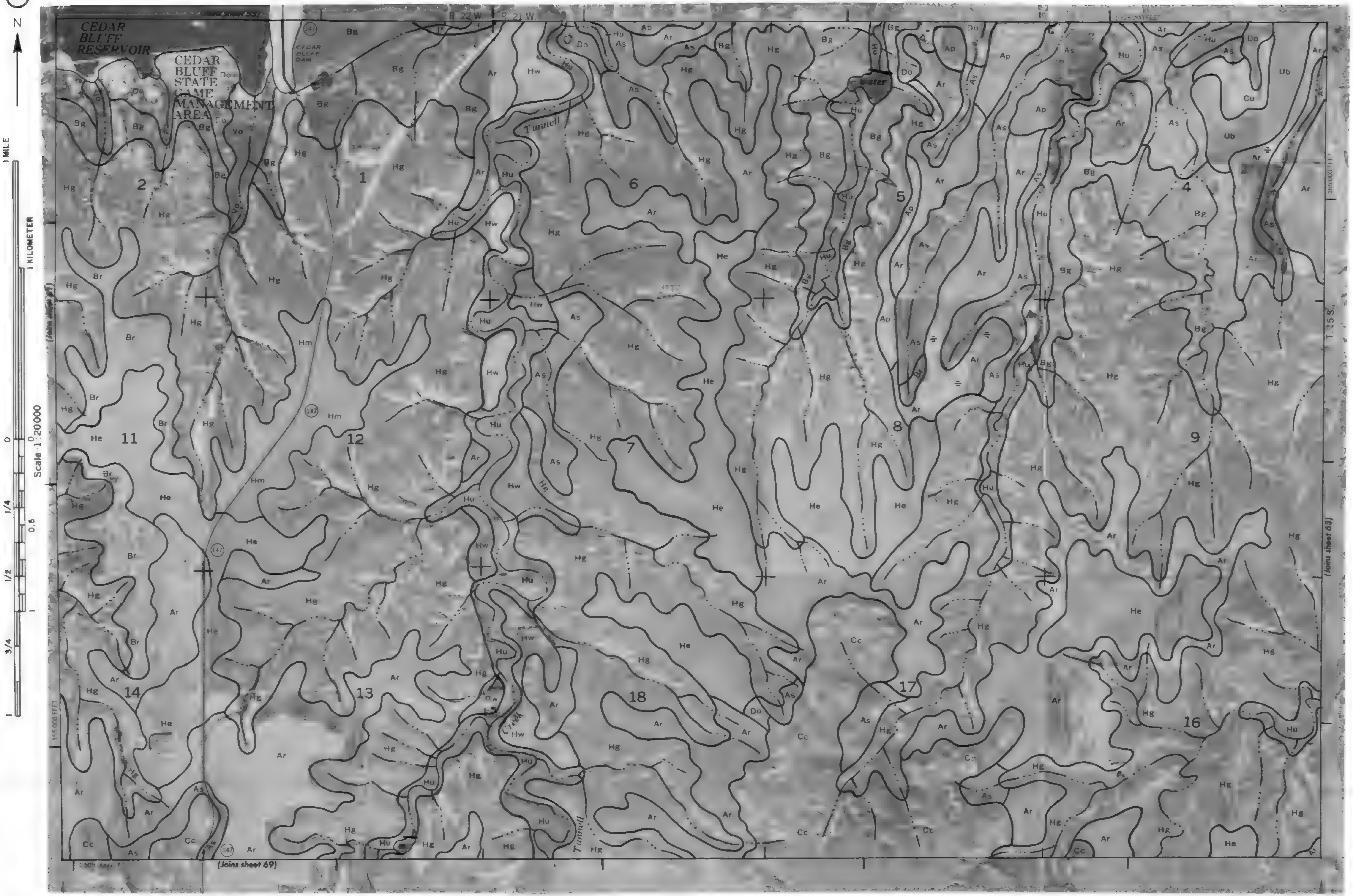

R. 25 W.
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 64)
GOVE COUNTY
T. 15 S.
Smoky Hill River
Wild Horse Creek
Gibson Creek
N
1 MILE
1 KILOMETER
Scale 1:20000


N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 51)
R. 25 W.
R. 24 W.
T. 15 S.
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 65)
Rattlesnake
Creek

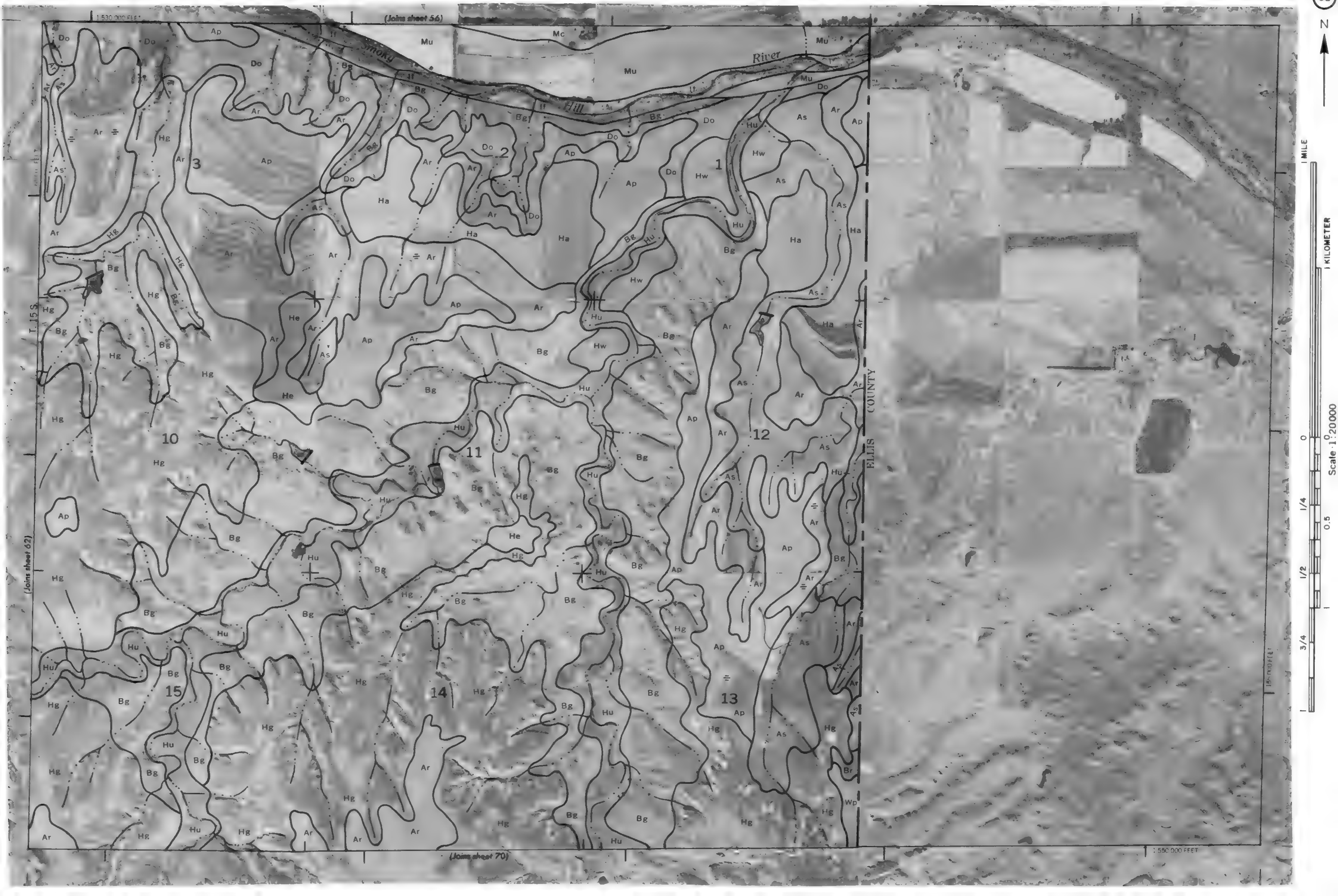

N
R. 24 W.
R. 23 W.
(Joins sheet 52)
(Joins sheet 58)
(Joins sheet 40)
(Joins sheet 66)
T. 15 S.
435 000 FEET
1 455 000 FEET
Smoky Hill River
Sand Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5


60
N
CEDAR BLUFF STATE GAME MANAGEMENT AREA
(Joins sheet 53)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 67)
R. 23 W.
T. 15 S.
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
0.5
1/2
3/4
1
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

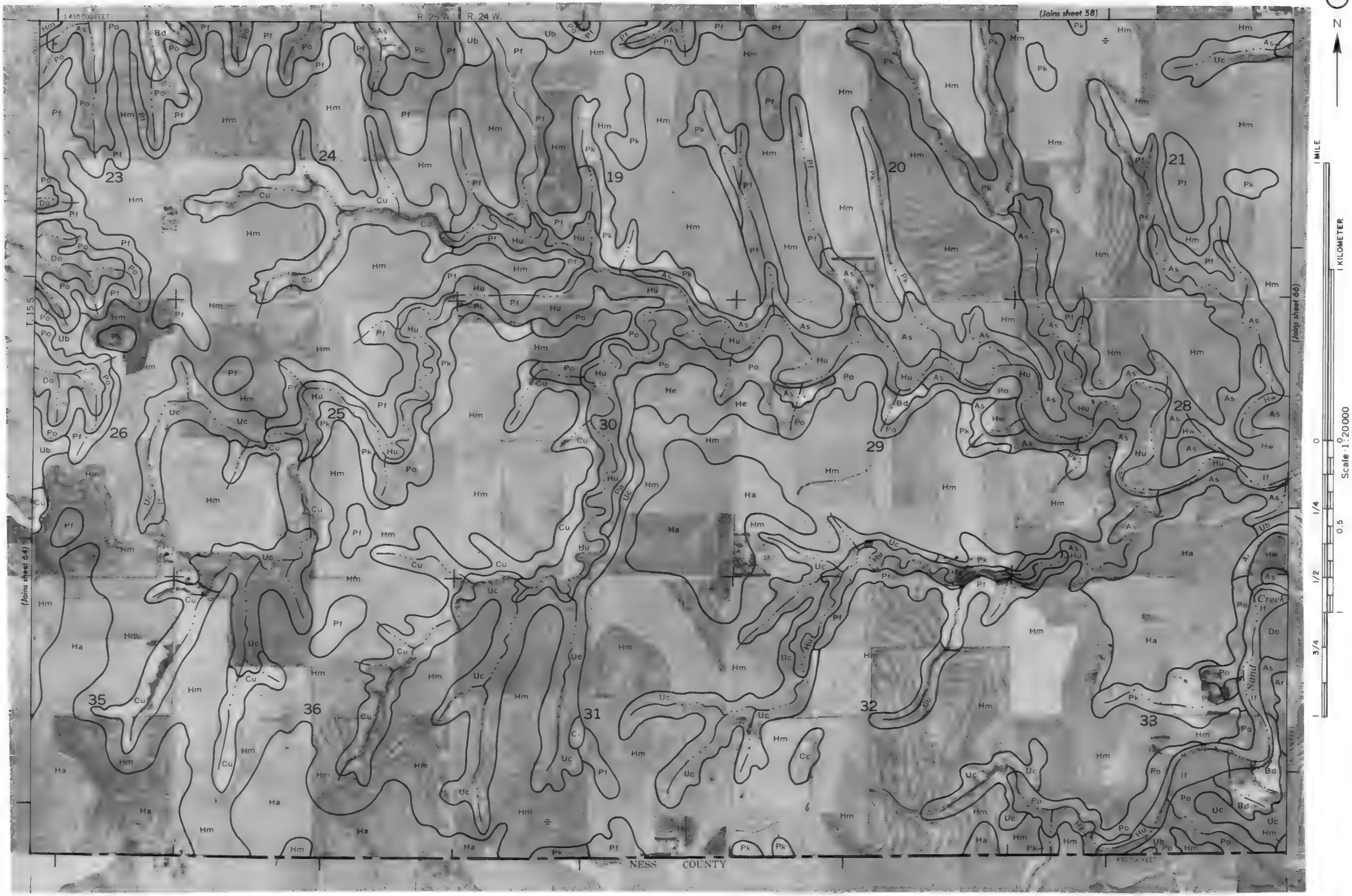

CEDAR BLUFF STATE GAME MANAGEMENT AREA
CEDAR BLUFF RES
CEDAR BLUFF RESERVOIR
Smoky Hill River
CEDAR BLUFF STATE GAME MANAGEMENT AREA
Page Creek
Page Creek
(Joins sheet 54)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 68)
R. 22 W.
T. 15 S.
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
CEDAR BLUFF RESERVOIR
CEDAR BLUFF STATE GAME MANAGEMENT AREA
CEDAR BLUFF DAM
R. 22 W.
R. 21 W.
T. 15 S.
Tunnell
Tunnell Creek
water
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 69)
147
155 000 FEET
1 505 000 FEET
165 000 FEET

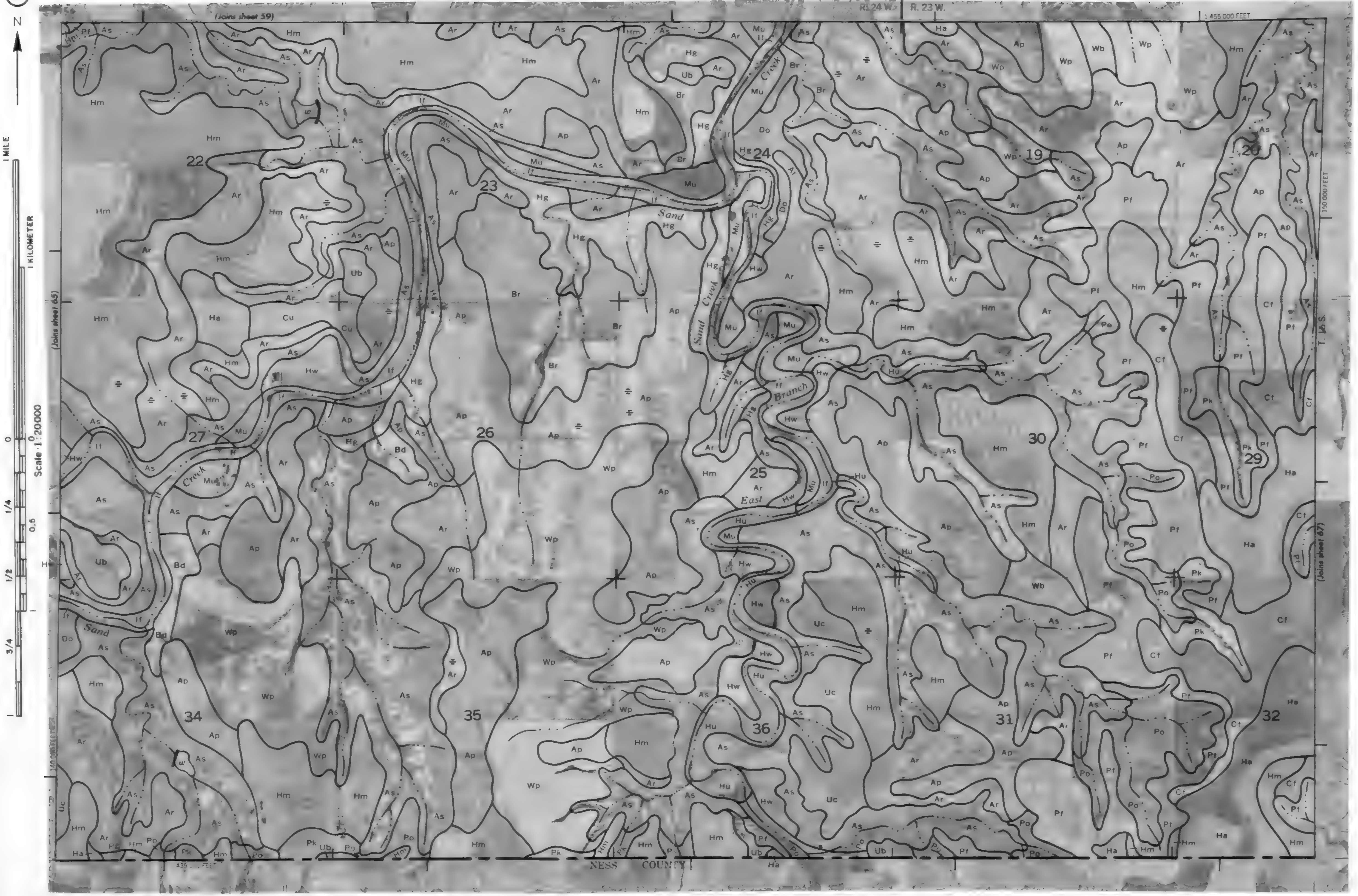
SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 63



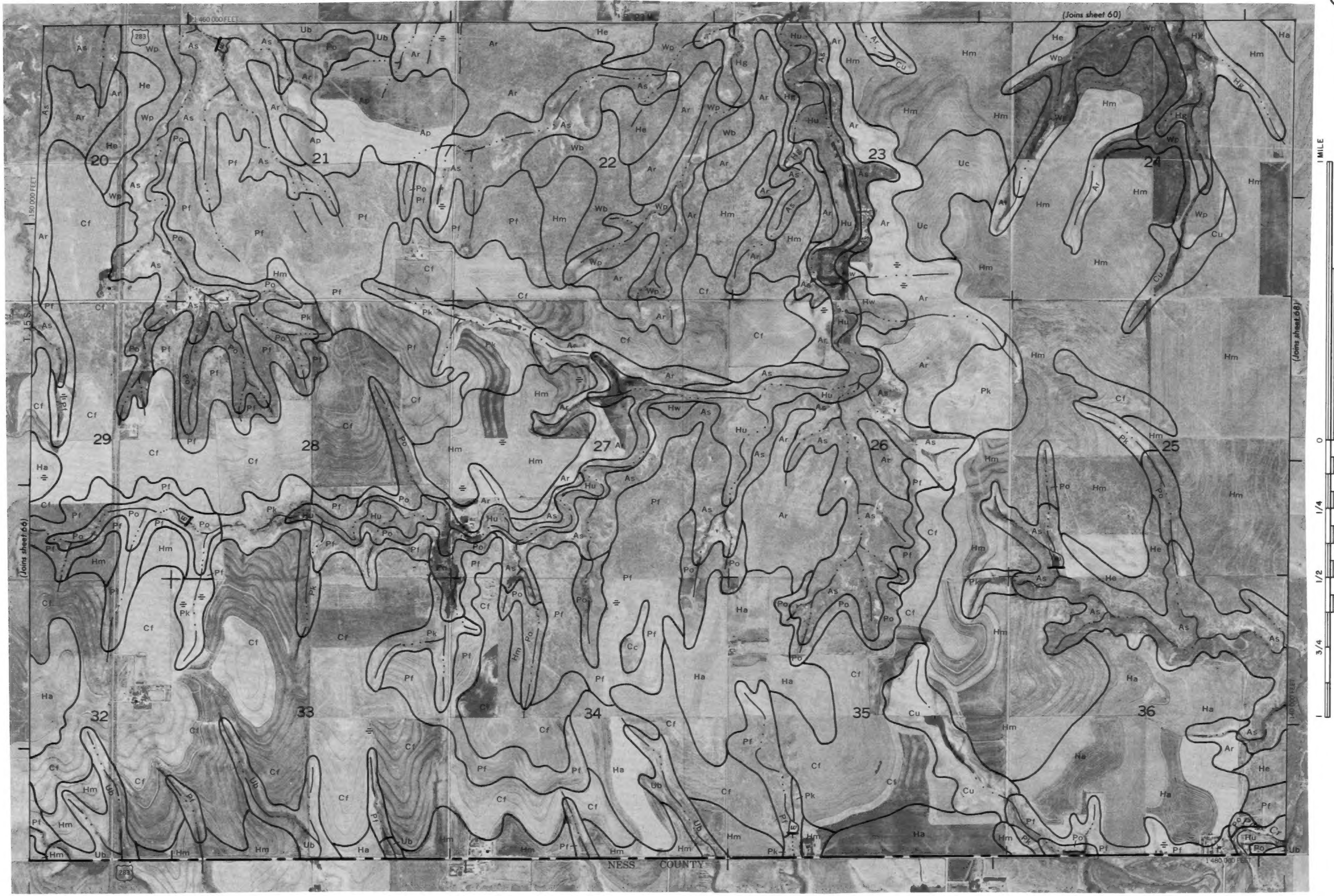

64
N
(Joins sheet 57)
R. 25 W.
T. 15 S.
(Joins sheet 65)
GOVE COUNTY
NESS COUNTY
Scale 1:20000
1 MILE
1 KILOMETER
Horse
Wild
Creek
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35


1 410 000 FEET
R. 25 W.
R. 24 W.
(Joins sheet 58)
(Joins sheet 66)
(Joins sheet 64)
T. 15 S.
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
NESS COUNTY
Sand Creek
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

66


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
0.5
1/2
3/4
1
(Joins sheet 59)
R. 24 W.
R. 23 W.
1 455 000 FEET
(Joins sheet 65)
(Joins sheet 67)
T. 15 S.
150 000 FEET
Sand Creek
East Branch
Creek
Sand
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
NESS COUNTY

67


(Joins sheet 60)
(Joins sheet 68)
(Joins sheet 66)
NESS COUNTY
1 460 000 FEET
150 000 FEET
T. 15 S.
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 61)
(Joins sheet 67)
(Joins sheet 69)
1 500 000 FEET
T. 15 S.
Page Creek
Creek
Page
NESS COUNTY
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35


69
N
(Joins sheet 62)
(Joins sheet 70)
(Joins sheet 68)
R. 22 W.
R. 21 W.
T. 15 S.
1 505 000 FEET
1 525 000 FEET
150 000 FEET
140 000 FEET
NESS COUNTY
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
147

SOIL MAP OF TREGO COUNTY, KANSAS — SHEET NUMBER 70